MAY 1959 – SIXTY-FIFTH YEAR

Machinery

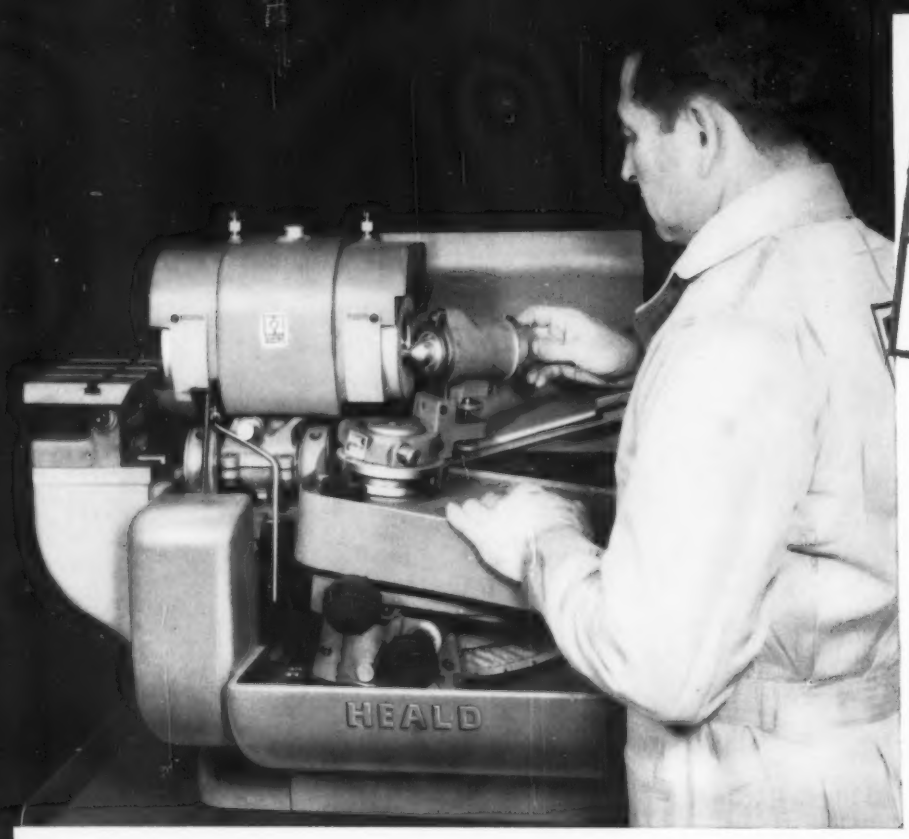
"all-around" milling with one set-up

The Brown & Sharpe
RANGEMASTER®

provides the biggest work capacity in its class. It saves you the extra cost of a bigger machine — saves still more on set-up and tooling costs. You get all ram-type machine advantages, *plus* the full metal-removing ability of a conventional knee-type machine of equivalent size. For toolroom, experimental, and prototype jobs—for "all-around" milling, it's by far your best investment. Universal or Plain. For details, write: Brown & Sharpe Mfg. Co., Providence 1, R. I.

In the typical RANGEMASTER job illustrated, the face and front T-slot of a 21"x24" casting are milled with the sliding head in full forward position. Without disturbing the work piece, the head is reset and moved to position shown for accurate parallel milling of rear face and slot. Dimensional capacity of a larger size machine would normally be required to take all these cuts with one set-up.

Brown & Sharpe BS



Another
NEW
PRODUCT
by Heald

☐ File for Reference
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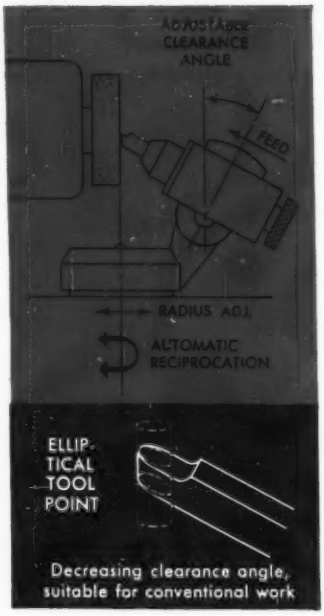

New Model 4 TOOL SHARPENING MACHINE

provides highest precision and economy for both **TRUE RADIUS** and **ELLIPTICAL POINT** tool grinding

SETTING new standards of accuracy and economy, the new Heald Model 4 Tool Sharpening Machine is available for both *true-radius* and conventional *elliptical-point* tool grinding. The True Radius arrangement provides a constant tip radius and constant clearance angle, permitting greater accuracy where the point of contact with the tool varies with the configuration of the workpiece, as in contoured shapes. Where such tool geometry is of no advantage, the Model 3 Tool Sharpening Machine, capable of grinding elliptical point tools only, offers desirable savings in initial cost.

With either model, you get *fully automatic tool reciprocation* providing uniform and repetitive tool tip accuracy which permits one operator to tend several machines at the *same time*. An occasional adjustment of the feed knob (as in photo above) is the only operator attention needed. Offhand grinding attachment at left end of machine is standard equipment, furnished at no extra cost.

Remember — in metal cutting, it's the precision of the *tool tip* that guarantees precision results. Ask your Heald representative for complete information on this new Model 4 Tool Sharpening Machine, or send for Bulletin 2-4-3, Issue 1.

It PAYS to come to Heald

HEALD

THE HEALD MACHINE COMPANY

Subsidiary of The Cincinnati Milling Machine Co.

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Machinery

MAY 1959 **VOL. 65 No. 9**

THE MONTHLY MAGAZINE OF ENGINEERING AND PRODUCTION IN THE MANUFACTURE OF METAL PRODUCTS

SHOP PRACTICE

Blades for Sikorsky Helicopters ..... Edgar Altholz 101
Hard-Surfacing Shaker Screens ..... George Giangrande 109
Cost-Cutting with Ceramics ..... Ben E. Storrs 111
Reduce Assembly Costs on High-Production Runs ..... G. E. Cade 116
How Product Redesign Removed Headaches .. John W. Berg and John L. Wingard 122
Power-Brushing Deburrs and Finishes Hydraulic Pump and Motor Components ..... Verne K. Charvat 124
Transfer Line Slashes Matching Time on Spray-Gun Bodies ... W. J. Tillman 127
Beryllium Forgings . . . Round-Trip Tickets to Space Travel? 136
Forging Aluminum on Advanced Design Presses 152

MACHINE AND TOOL DESIGN

A Machine Tool Builder Looks at Numerical Control ..... Gordon A. McAlpine 119
Threading Tool Angles Solved Graphically ..... Sherwood C. Bliss 130
Miniature Differentials Assembled by "Knurl Broaching" 132
Multiple-Revolution Ratchet Movement ..... L. Kasper 137
Machine Counter with Dwell Interval Operated Through Slotted Discs Ralph T. Stewart 138
Diamond Dresser Preserves Distance Between Wheel and Work Center Line Cliff Bossmann 142
Sides of Work-Piece Utilized to Facilitate Piercing ..... Richard Minser 143
American Standard Driving and Spindle Ends for Portable Air and Electric Tools (Data Sheet) 209

MANAGEMENT PROBLEMS

An Inch Is Now an Inch ..... Charles O. Herb 99
Don't Let Promotion Outstrip Product Performance ..... Bernard Lester 151

REFERENCE SECTION

What the Designer Should Know About Production—Part 8 Assembly of Machined Parts ..... Theodore Koerner, Jr. 145

DEPARTMENTS

Keeping Up with Washington 97
Materials 133
Ingenious Mechanisms 137
In Shops Around the Country 140
Tool Engineering Ideas 142
Talking with Sales Managers 151
Shop Kinks 154
Latest Developments in Shop Equipment 156
New Catalogues 181
Between Grinds 204
News of the Industry 206
Data Sheet 209
Coming Events 218
Book Reviews 218

PRODUCT DIRECTORY
224

SBME Society of Business Magazine Editors

ADVERTISERS' INDEX
301-302

How to SAVE TIME in your threading operation

Plants throughout the world save valuable time in their threading operations using Landis Machine Company Threading Equipment. For example:

A LANDIS ALT COLLAPSIBLE TAP produces coarse pitch threads in less than a minute in one pass at the Holys Manufacturing Co., Forest Park, Ill. The ability of the LANDIS Tap to tap large diameter coarse pitch threads requiring heavy metal removal *in one pass* reduces threading time.

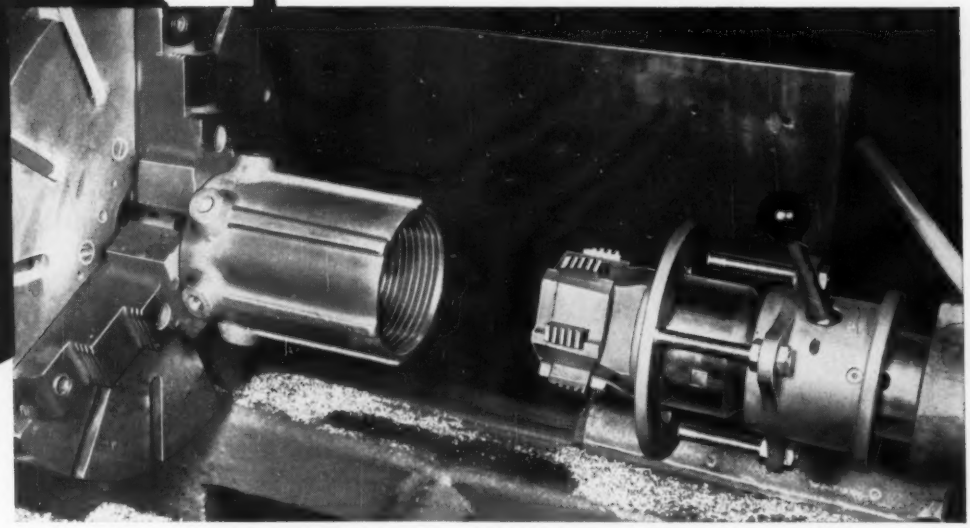
544C

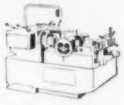
material: SAE 63 naval bronze casting

thread specifications:

Diameter	4.640"
Length	4-1/4"
Type	4 pitch modified square

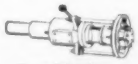
equipment: LANDIS 5ALT Tap with a 4½" tap head on a No. 5 Gisholt turret lathe.



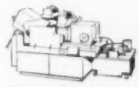


Threading Machines

Die Heads—Rotary & Stationary

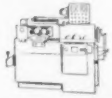


Taps—Collapsible & Solid Adjustable



Centerless Thread Grinding Machines

Thread Rolling Tools



Thread Rolling Machines

This installation is but one example of the hundreds of plants that are receiving the time-saving (money-saving!) benefits of the various types of Landis Threading Equipment.

Over fifty years of development and manufacturing experience by the Landis Machine Company, a corporation devoted to the exclusive manufacture of threading equipment, is behind every Landis threading machine or tool you use. Take advantage of our technical and practical experience in Thread Cutting, Rolling, Tapping, and Grinding. We offer any help needed to ensure you of a successful Threading Operation.

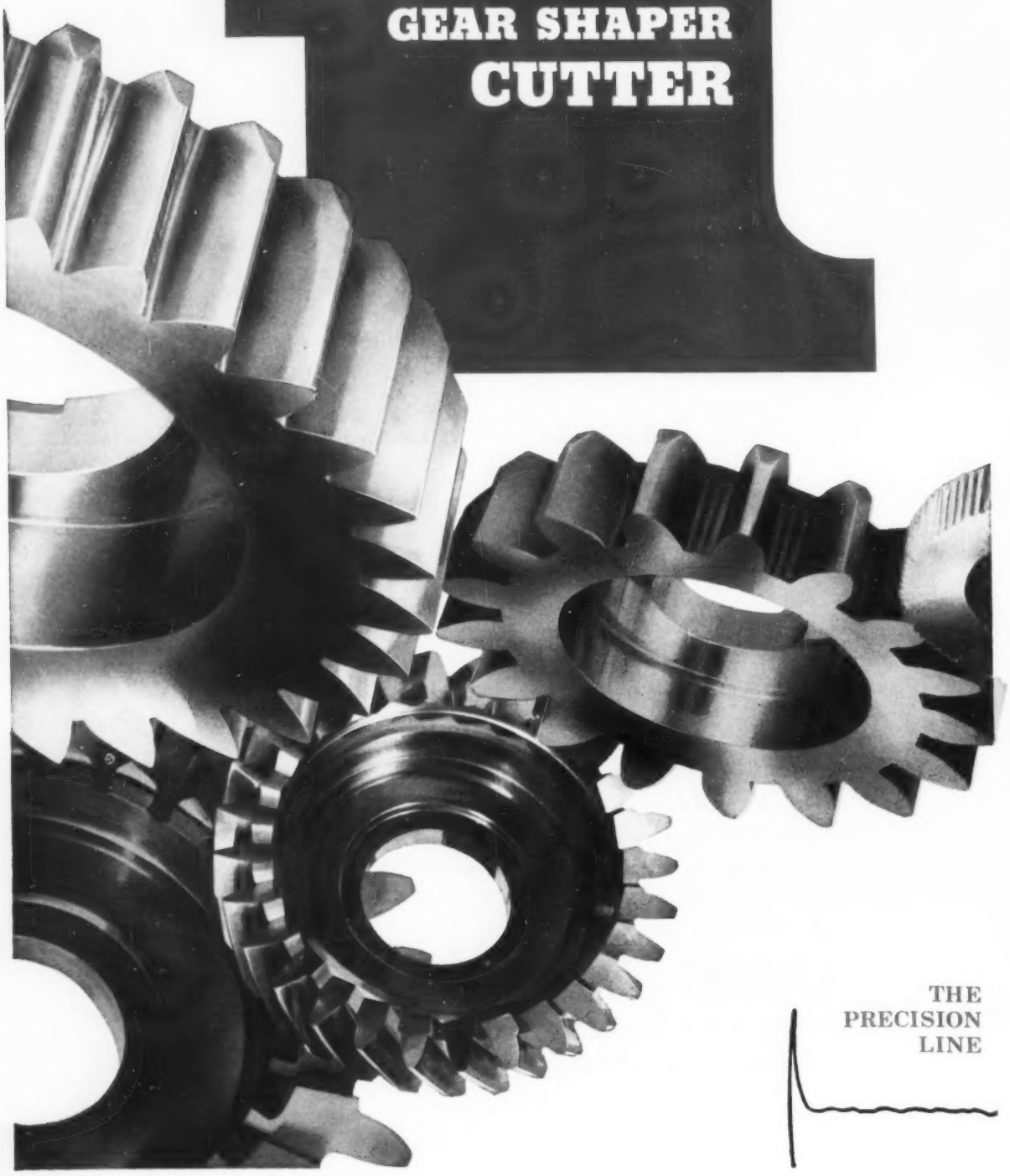
LANDIS *Machine* COMPANY

WAYNESBORO • PENNSYLVANIA

THE WORLD'S LARGEST MANUFACTURER OF THREADING EQUIPMENT

1 FELLOWS MADE THE FIRST GEAR SHAPER CUTTER

...and



THE PRECISION LINE

FELLOWS
still makes the BEST

The Fellows Cutters you order today have unequalled experience behind their manufacture: the first gear shaper cutter ever made was designed, produced and patented by Fellows in 1897. Hundreds of thousands of Fellows Cutters have been made and used on gear production lines since that time.

This vast experience has resulted in constant progress, year after year, in cutter design and manufacture. Today, new gear and cutter designs are checked on a high-speed electronic computer which permits complete mathematical study of all possibilities. Constant advances in metallurgy and in manufacturing methods assure outstanding cutter performance on every gear production job.

A booklet, "Fellows Gear Shaper Cutters", covers the subject in detail. It includes tables of stock cutters, design considerations, sharpening methods, and other information. For a copy, contact any Fellows office.

THE FELLOWS GEAR SHAPER COMPANY
78 River Street, Springfield, Vermont
Branch Offices: 1048 North Woodward Avenue, Royal Oak, Mich.
150 West Pleasant Avenue, Maywood, N. J.
5835 West North Avenue, Chicago 39
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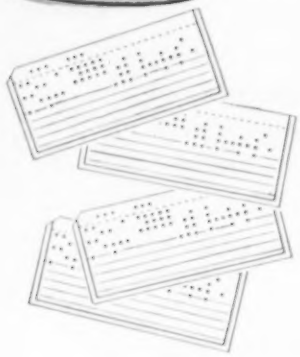
Fellows *Gear Production Equipment*

For more data, circle this page number on inquiry card

Cincinnati Numerical

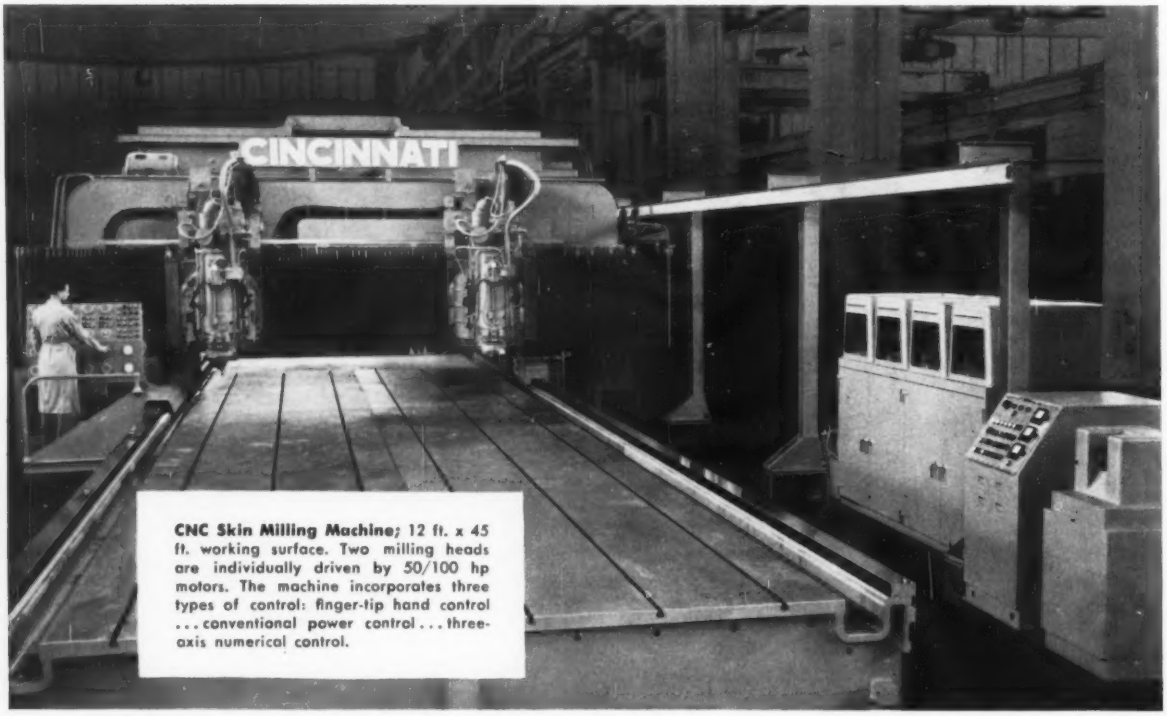
gives you positive COST CONTROL



No more "cut and try" for machining operations. No change in setup for rough and finish cuts, new and reground cutters, right- and left-hand parts. No operator fatigue near the end of the shift. These are some of the ways in which Cincinnati Numerically Controlled (CNC) Machine Tools give you positive cost control at the machine.

Other CNC advantages: **Single Responsibility** . . . coordinated, cooperative effort by Cincinnati specialists in numerical control and in every activity required to deliver completely integrated machines. **Simple Programming** . . . CNC requires fewer input data points. **Precision Machining** . . . CNC is an absolute digital-analog system, assuring precise accuracy. **Simple to Use, Versatile.**

Cincinnati Numerical Control is the newest, most positive way to reduce lead time and many non-productive elements of excessive machining costs. Want specific job application data? Just present your production problems to us. You may obtain preliminary information by writing for publication M-2066.



CNC Skin Milling Machine; 12 ft. x 45 ft. working surface. Two milling heads are individually driven by 50/100 hp motors. The machine incorporates three types of control: finger-tip hand control . . . conventional power control . . . three-axis numerical control.

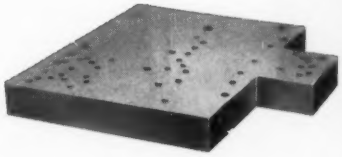
BUILDERS OF FINE MACHINE TOOLS: MILLING • GRINDING • BROACHING • DIE SINKING • CUTTER AND TOOL GRINDING

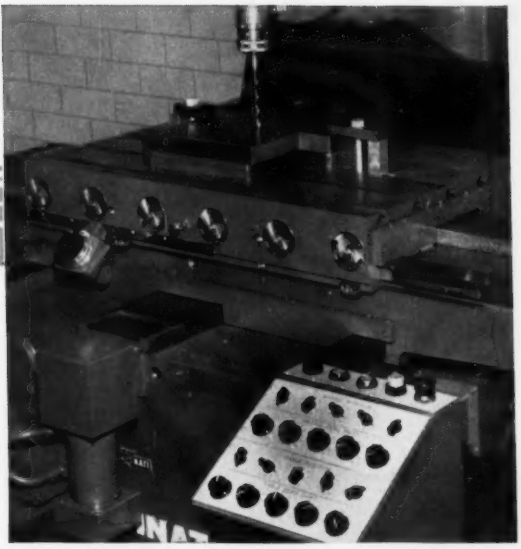
THE CINCINNATI MILLING MACHINE CO., CINCINNATI 9, OHIO

Control

at the machine

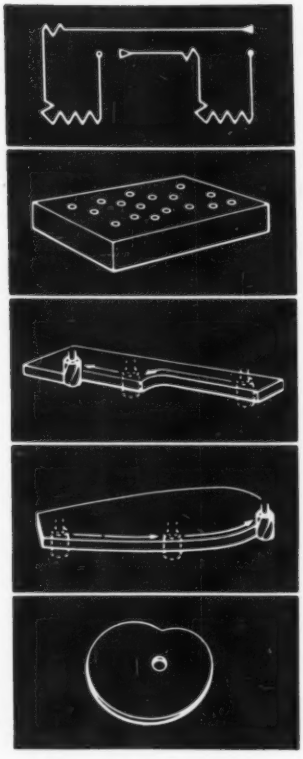
CINCINNATI





CNC position control. Drilled holes in the part (left) are accurately spaced without benefit of a jig or time-consuming positioning on the machine table.

PRINCIPAL AREAS OF APPLICATION FOR CNC



SEQUENCE CONTROL

CNC assures reliable automatic selection of feeds, speeds, spindles, coolant flow and other auxiliary machine functions.

POSITIONING

Tool-work positioning is fast, accurate. CNC eliminates need for expensive jigs, fixtures; reduces setup time.

STRAIGHT LINE CUTS

Multiple straight line cuts to exact length, and with abrupt changes in direction, can be programmed, set up and run in a fraction of the time required using conventional methods.

CONTOURING

CNC greatly reduces lead time in reproducing complex, contoured parts; eliminates need for expensive templates, masters.

CAM MILLING

Fast, extremely accurate machining of master cams is assured on CNC controlled machines. CNC system of parabolic interpolation greatly simplifies programming of cam contour.

• PRODUCTION LINES • METAL FORMING, HARDENING MACHINES

CINCINNATI®

new Landis truform dresser maintains closer

LANDIS

precision grinders

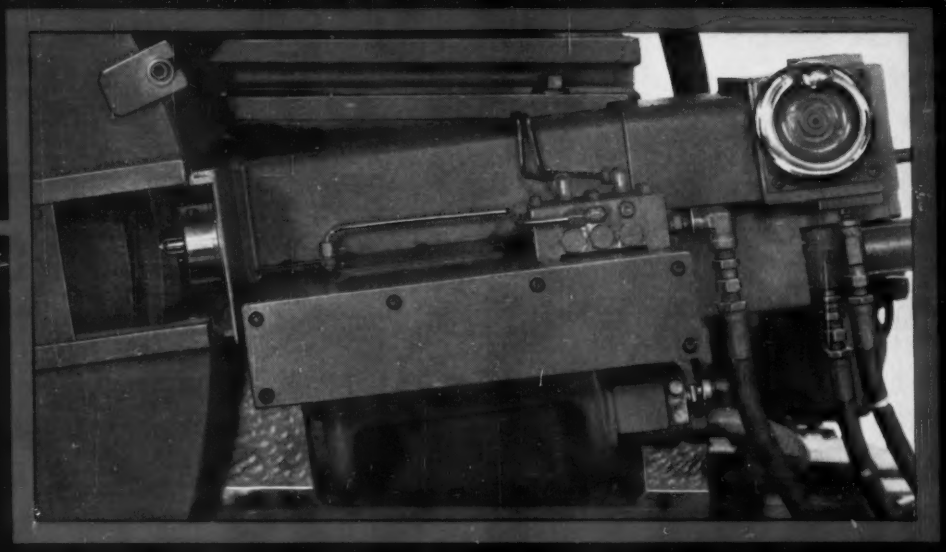
New Landis R Plunge Grinder with new TRUFORM dresser, automatically grinding 3 diameters and face of transmission shaft in one operation.

LANDIS TOOL COMPANY / WAYNESBORO, PENNSYLVANIA

improves accuracy, tolerances

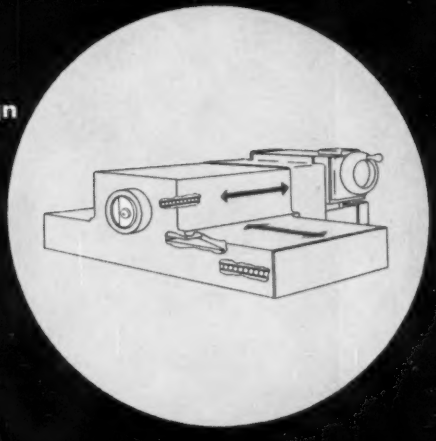
TRUFORM DRESSER is an exclusive Landis development with these special advantages:

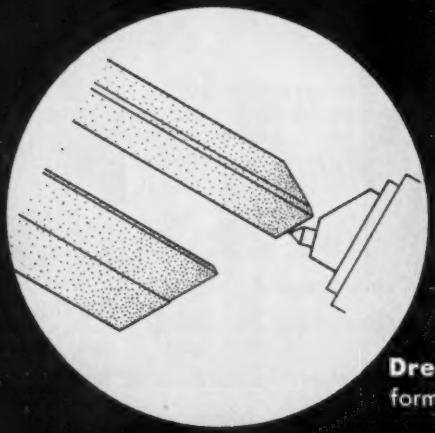
- preloaded ball slide with no shake gives more accurate dressing
- dresses in either direction up to 60° angles
- pushbutton control assures uniform dressing cycles
- built-in accuracy cuts dressing time—saves on diamond costs
- automatic lubrication for continuing accuracy



Exceptional accuracy and stability always assure exact duplication of the profile to the wheel.

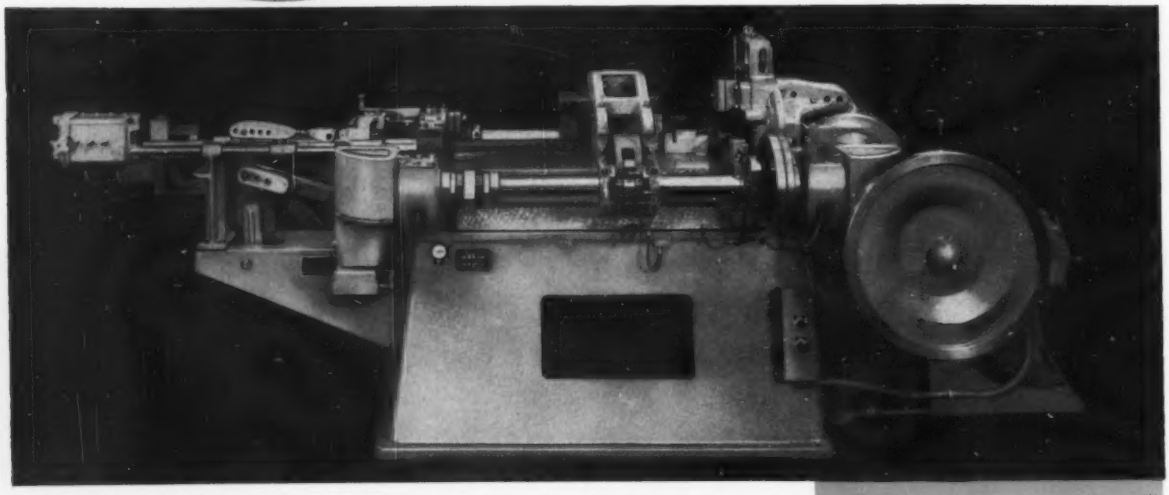
New pre-loaded ball-slide design eliminates shake for accurate dressing.





Dresses a Profile of 60°—new dressing efficiency forms wheel profiles not possible before.

MULTI-SLIDE®



Model #35 U. S. Multi-Slide Machine in which 4 die heads (rams) can be used simultaneously.

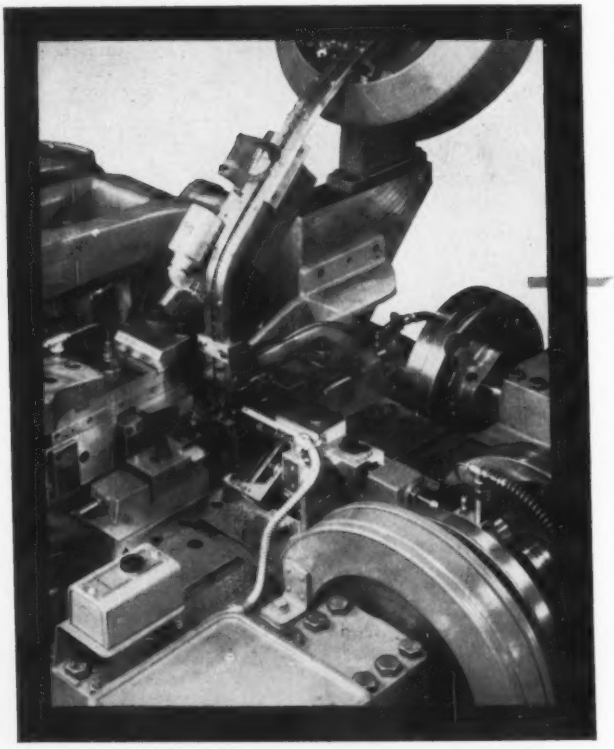


FIGURE 1A

FIGURE 1

FIGURE 2

MACHINES

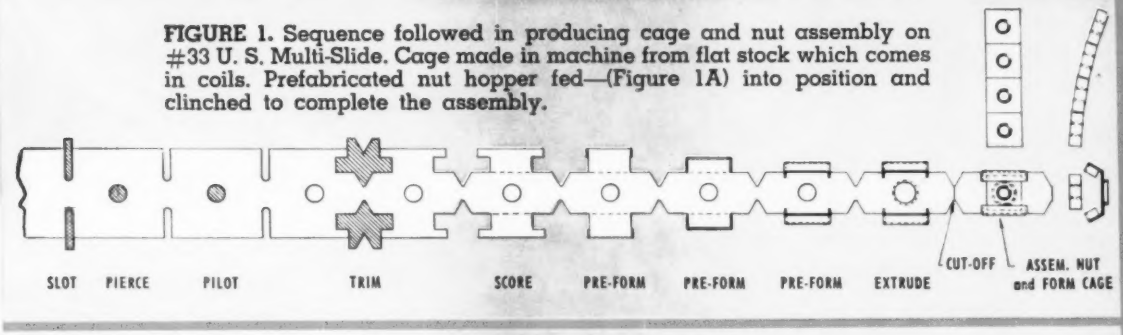
Reduce Pressroom Costs

The versatility of the U. S. Multi-Slide for the production of stampings, or assemblies which include stampings, enables you to reduce piece part costs by eliminating expensive secondary operations.

The various movements obtainable with the standard machine equipment allow for automatic production of intricately formed stampings—complete in one operation. Then, a variety of auxiliary attachments, available for use in conjunction with the standard movements, make it possible to go further and fabricate many different types of assemblies—**in the machine —a completed assembly at each cycle.**

Ask for a copy of Bulletin #15 (M) or, to compare manufacturing costs send in samples or drawings of the part you want to produce.

FIGURE 1. Sequence followed in producing cage and nut assembly on #33 U. S. Multi-Slide. Cage made in machine from flat stock which comes in coils. Prefabricated nut hopper fed—(Figure 1A) into position and clinched to complete the assembly.



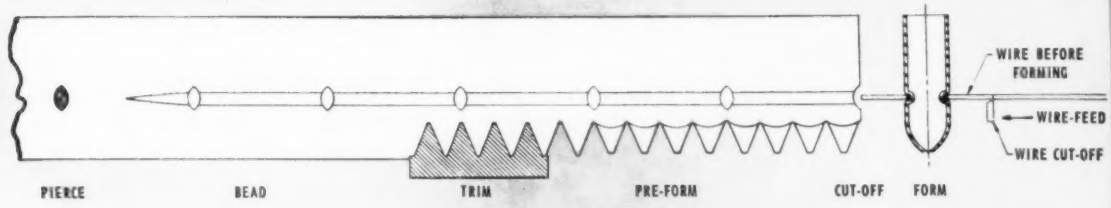


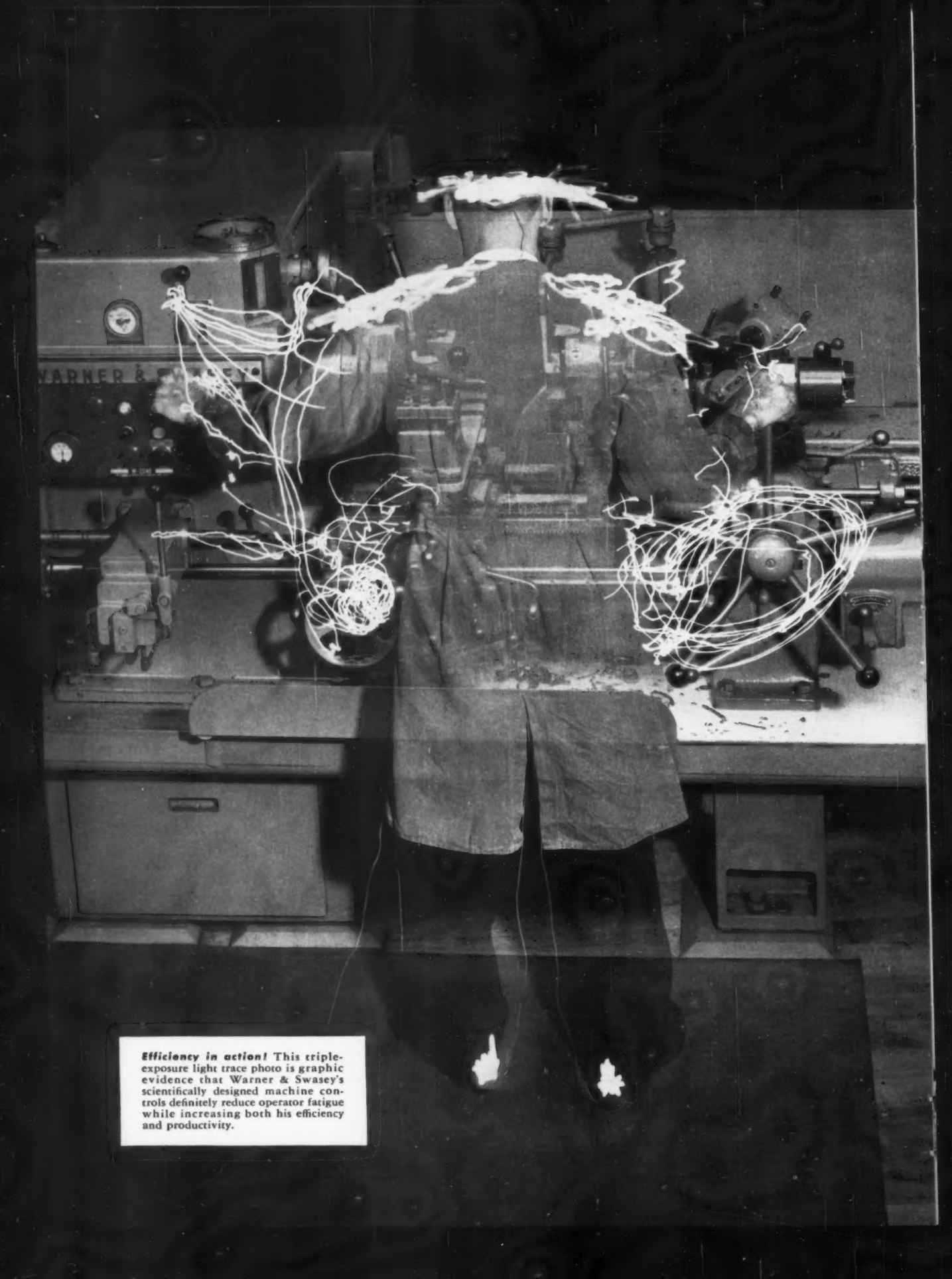
FIGURE 2. Tube reinforcement consists of a flat stock stamping and a wire part—both produced and assembled in a #35 U. S. Multi-Slide. Flat stock progressed from left to right and wire from right to left as indicated. Assembly completed in final forming position.

US PRODUCTS

U. S. TOOL COMPANY, INC.

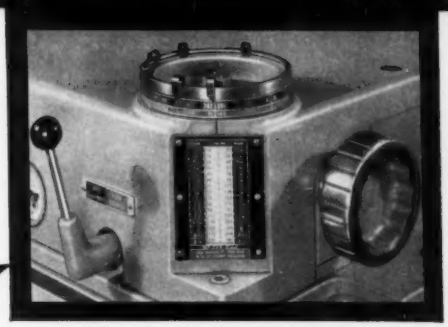
AMPERE *(EAST ORANGE)* NEW JERSEY

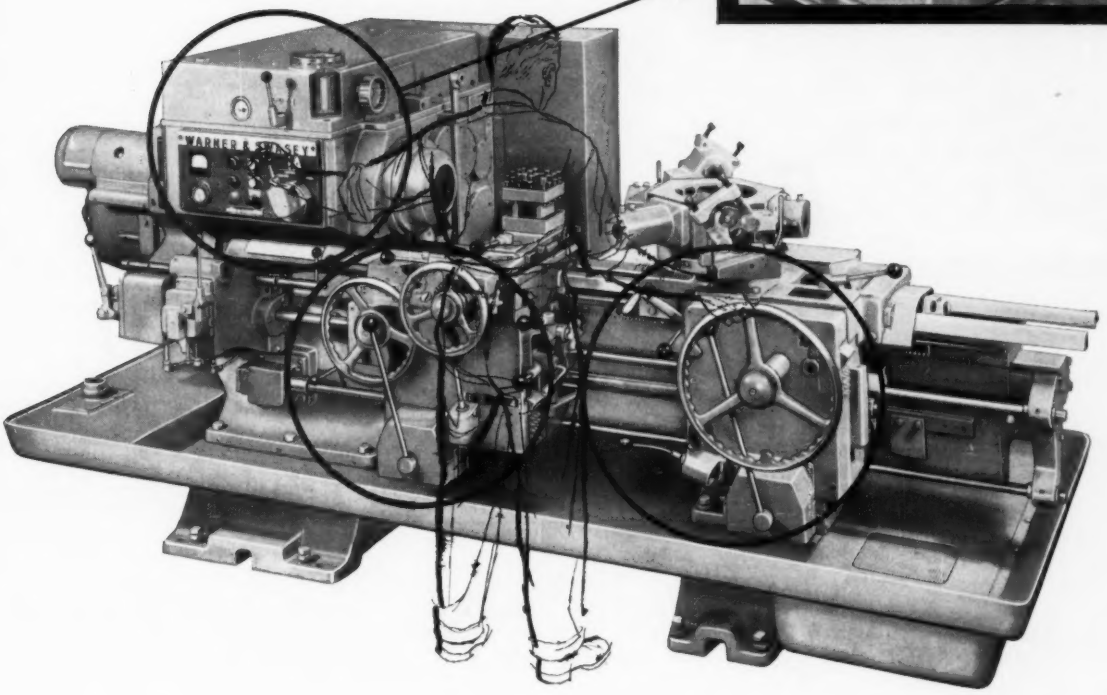
U. S. Multi-Slides® • U. S. Multi-Millers® • U. S. Automatic Press Room Equipment • U. S. Die Sets and Accessories



Efficiency in action! This triple-exposure light trace photo is graphic evidence that Warner & Swasey's scientifically designed machine controls definitely reduce operator fatigue while increasing both his efficiency and productivity.

This exclusive Warner & Swasey Speed Preselector, heart of the "zoned controls" system, enables the operator to preselect the correct speed for each cut, with just a glance-and-a-twist of the knurled knob. Proper speeds are chosen for the required cuts on the job and then marked in sequence with numbered clips placed on the top of the chart drum. Just a touch of the lever instantly shifts the machine to the next desired speed.





Warner & Swasey Zoned Controls boost production by increasing operator efficiency

Known throughout industry as "the operator's machine", Warner & Swasey turret lathes are painstakingly designed with the human element in mind. They provide easy-to-handle operating controls, compactly arranged at convenient levels that minimize stooping and reaching — all of which contribute to increased operator satisfaction and higher production. Heart of the "zoned controls" system is Warner & Swasey's exclusive Speed Preselector — calibrated in surface feet and spindle RPM's versus work diameters — that encourages operator use of the proper spindle speeds for the particular job being machined. Additional single lever control features praised by operators include: A fast, simple change for spindle speeds; apron feed levers with "feel" control; four-way carriage rapid traverse; easy operating turret units and hydraulic collet chuck and bar feed control. For more detailed information about the adaptability of Warner & Swasey turret lathes to your particular machining problems, call in our Field Representative, today.

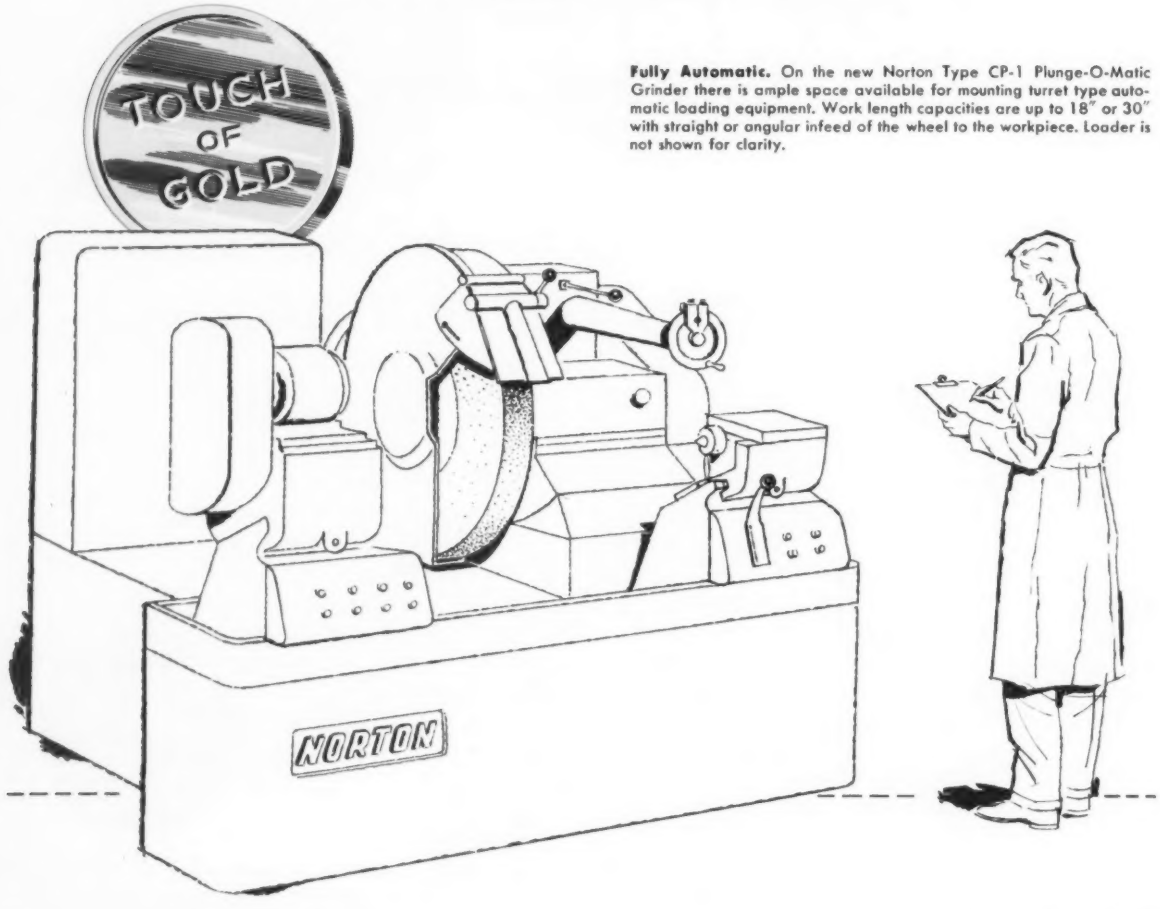
WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS...WITH A WARNER & SWASEY

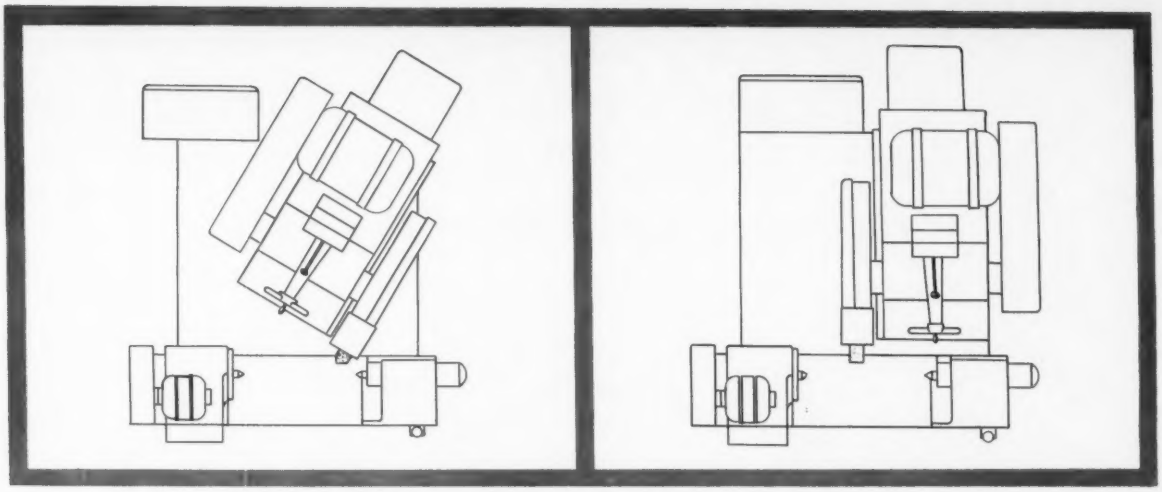
For more data, circle this page number on inquiry card

Built for one big purpose!

New Norton Plunge-O-Matic* Grinder simplifies



Fully Automatic. On the new Norton Type CP-1 Plunge-O-Matic Grinder there is ample space available for mounting turret type automatic loading equipment. Work length capacities are up to 18" or 30" with straight or angular infeed of the wheel to the workpiece. Loader is not shown for clarity.



Versatility of design allows positioning the wheelhead as required for the job. Those shown are only two of many possible variations.

automatic loading for mass production grinding

In design, the Norton Type CP-1 Plunge-O-Matic Grinder is brand new. While retaining outstanding proven features of Norton cylindrical grinders — and co-ordinating them with a new turret type loader for fast, automatic plunge grinding — it has no unnecessary mechanism.

As traverse grinding is not involved, swivel and sliding tables, hydraulic table cylinder and attendant control valving have been eliminated. Taper adjustments are made in the automatic truing device located in the wheelhead. The base contains no inner mechanism, its sole function is to rigidly support the headstock, footstock, wheel slide and loader.

This machine provides for automatic loading — a new departure from the usual cylindrical grinder design. On the Plunge-O-Matic Grinder the gap in front of the grinding wheel is 19″ deep by 18″ or 30″ work length — ample space to accommodate the new turret loader. And since one type of loader can handle many parts, only the loader insert, which actually holds the parts, needs specific designing. This reduces the original cost and operating maintenance of automatic loading.

The Plunge-O-Matic wheel slide, unitized and entirely independent, carries grinding wheels of 30″ or 36″ diameter and can be located as desired on the base. Complete flexibility for angular grinds is assured, and heavy duty grinding with wide or multiple wheels can be provided for.

Your Norton Sales Engineer, a trained specialist in grinding, will be glad to give you more facts about the Plunge-O-Matic Grinder — with an accurate estimate of how much you can save. NORTON COMPANY, Machine Division, Worcester 6, Mass. District Offices: Worcester, Hartford, Cleveland, Chicago, Detroit. *In Canada:* J. H. Ryder Machinery Co., Ltd., Toronto 5.

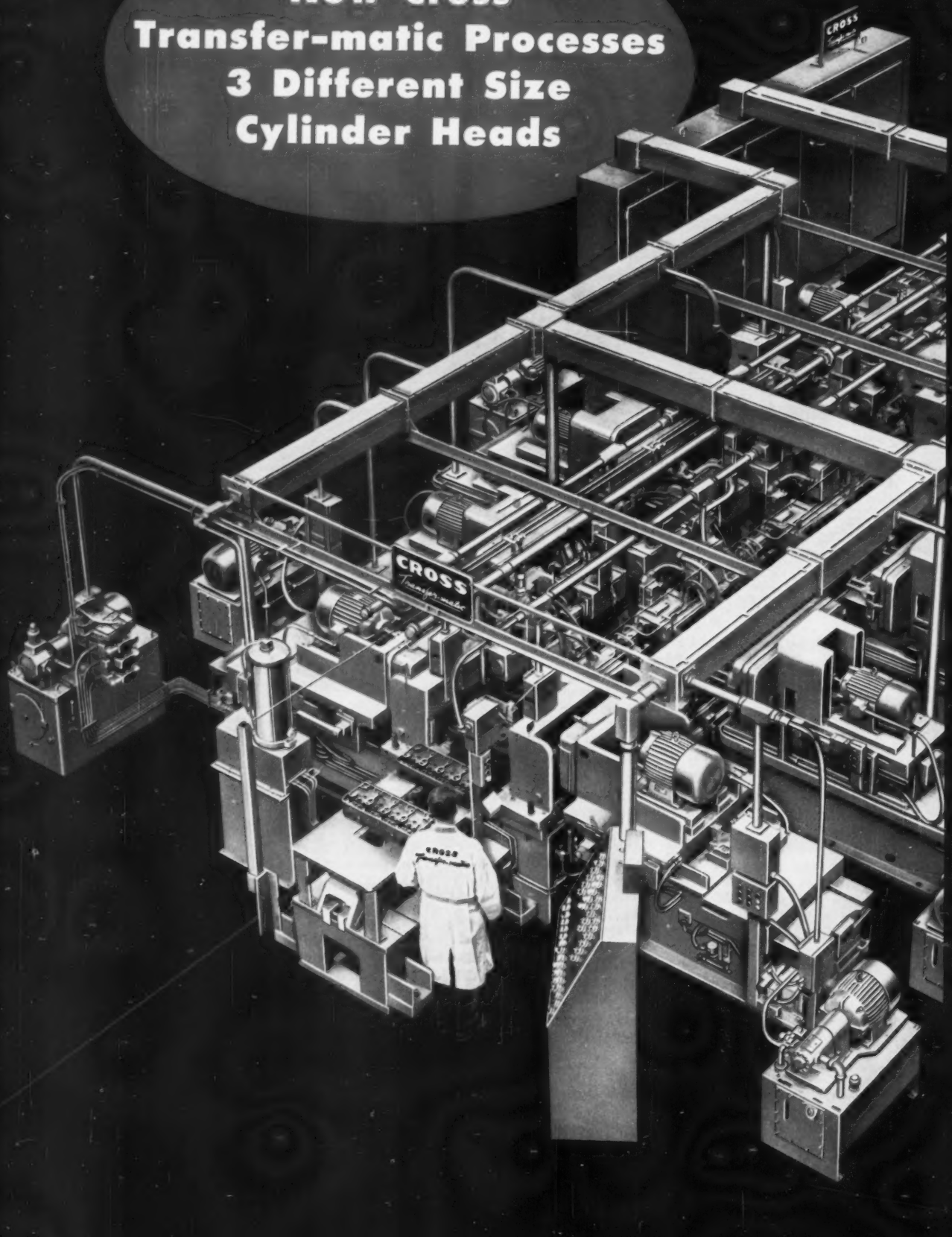
*Trade-Mark Reg. U.S. Pat. Off. and Foreign Countries

NORTON
GRINDERS *and* LAPPERS
Making better products
to make your products better

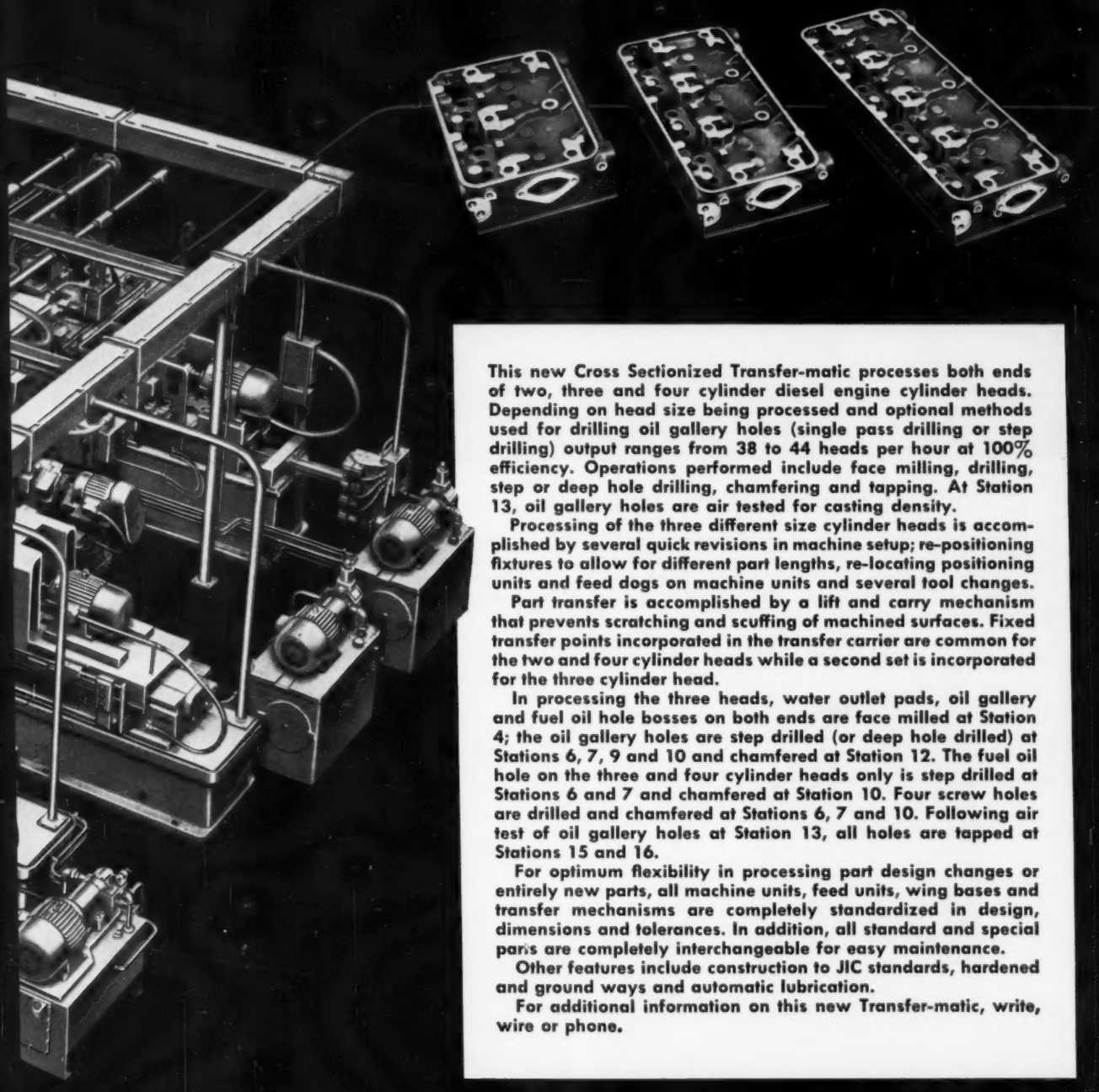
NORTON PRODUCTS Abrasives • Grinding Wheels • Grinding Machines • Refractories • Electrochemicals — BEHR-MANNING DIVISION Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes

For more data, circle this page number on inquiry card

New Cross Transfer-matic Processes 3 Different Size Cylinder Heads



Another Automation First by Cross



This new Cross Sectionized Transfer-matic processes both ends of two, three and four cylinder diesel engine cylinder heads. Depending on head size being processed and optional methods used for drilling oil gallery holes (single pass drilling or step drilling) output ranges from 38 to 44 heads per hour at 100% efficiency. Operations performed include face milling, drilling, step or deep hole drilling, chamfering and tapping. At Station 13, oil gallery holes are air tested for casting density.

Processing of the three different size cylinder heads is accomplished by several quick revisions in machine setup; re-positioning fixtures to allow for different part lengths, re-locating positioning units and feed dogs on machine units and several tool changes.

Part transfer is accomplished by a lift and carry mechanism that prevents scratching and scuffing of machined surfaces. Fixed transfer points incorporated in the transfer carrier are common for the two and four cylinder heads while a second set is incorporated for the three cylinder head.

In processing the three heads, water outlet pads, oil gallery and fuel oil hole bosses on both ends are face milled at Station 4; the oil gallery holes are step drilled (or deep hole drilled) at Stations 6, 7, 9 and 10 and chamfered at Station 12. The fuel oil hole on the three and four cylinder heads only is step drilled at Stations 6 and 7 and chamfered at Station 10. Four screw holes are drilled and chamfered at Stations 6, 7 and 10. Following air test of oil gallery holes at Station 13, all holes are tapped at Stations 15 and 16.

For optimum flexibility in processing part design changes or entirely new parts, all machine units, feed units, wing bases and transfer mechanisms are completely standardized in design, dimensions and tolerances. In addition, all standard and special parts are completely interchangeable for easy maintenance.

Other features include construction to JIC standards, hardened and ground ways and automatic lubrication.

For additional information on this new Transfer-matic, write, wire or phone.

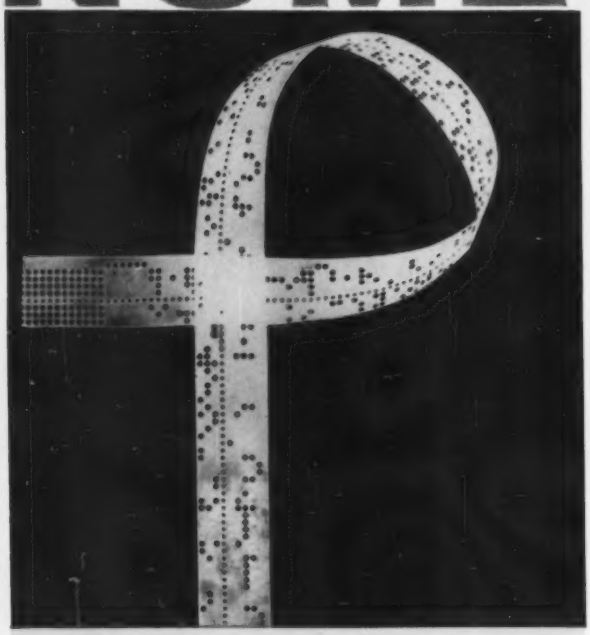
Established 1898

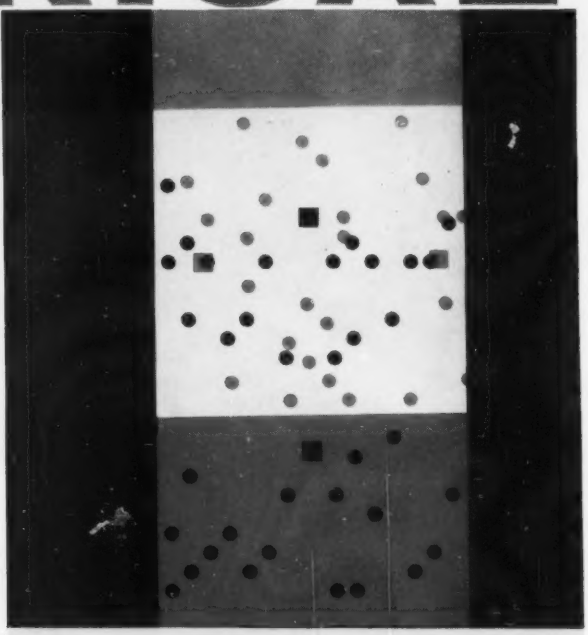
THE CROSS CO.

First in Automation

PARK GROVE STATION • DETROIT 5, MICHIGAN

NUMERICAL





1," 8-CHANNEL COMMUNICATIONS TAPE

Inexpensive, widely used throughout industry, these tapes may be prepared simply on a Flexowriter or similar equipment, usually by the Production Engineering Dept. Provides a typewritten record automatically for easy checking against pre-planned program.

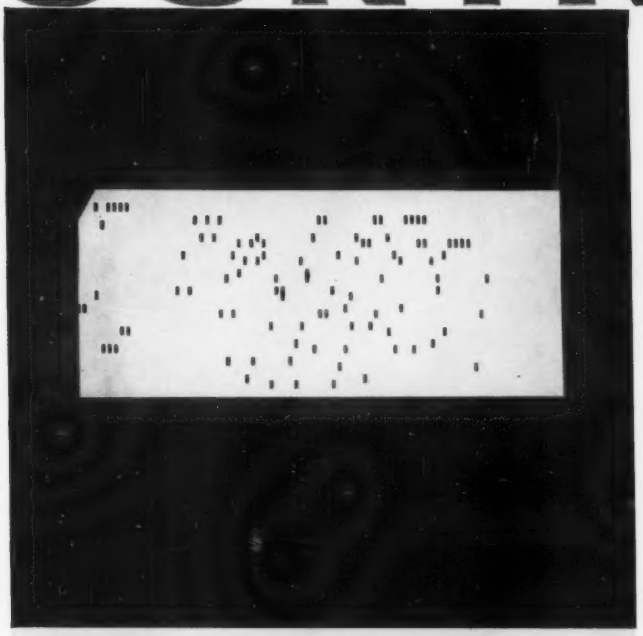
4" MYLAR PLASTIC TAPE

Least expensive of the generally accepted tape systems, particularly suitable for smaller shops machining parts with relatively few holes. Tape can be prepared easily by shop personnel.

1," 8-CHANNEL COMMUNICATIONS TAPE

4" MYLAR PLASTIC TAPE

CONTROL



for Fosmatic JIG BORERS and JIG GRINDERS

Any tape or card reader can be used to control a Fosmatic Jig Borer or Jig Grinder. And because the functions of the standard Fosmatic are actuated electrically, numerical control can be installed in the field—economically!

Speeds and feeds are changed by controlling electro-magnetic clutches through relay contacts. Table and saddle position is determined by a measuring system actuated by direct reading dials. For numerical control, these dials are driven by a fractional hp motor.

On a Fosmatic, you can program as many functions as you wish. Table X and Y positions (to .0001"), Feeds and Speeds, Spindle start and stop, Spindle feed start and stop, Spindle feed depth, Spindle head height, Automatic tool change. And only Fosmatic gives you a visual numerical check of coordinate location plus operation sequence number.

Example of savings made with Fosmatic numerical control. The illustration (left) shows one half of a mold with 900 cavities, each of which requires nine operations—a total of 8100! Time for the entire job was 100.25 hours, 25% of time consumed previously on a conventional jig borer.

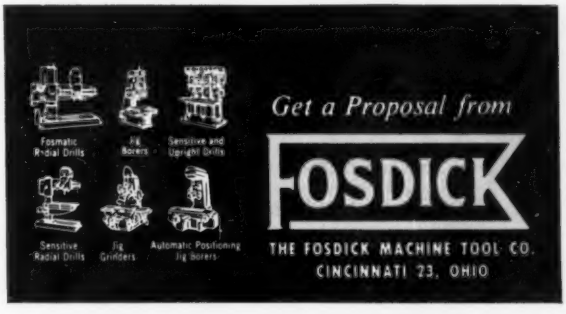
Write or call today for complete information on a numerically controlled jig borer or jig grinder to improve your production method.

PUNCHED CARDS

This system can be integrated with card systems already in use by your company. Each job is programmed in a "deck" of cards; provides great flexibility, since an operation can be added or eliminated simply by making a new card or removing an old one.

PUNCHED CARDS

Buy a Fosmatic today—add Numerical Control tomorrow



For more data, circle this page number on inquiry card

This is a MARVEL High-Speed-Edge Hack Saw Blade Cutting a 4" x 4" Titanium Billet

EVERYTHING'S IMPROVED BUT THE GUARANTEE

33 years ago, MARVEL introduced the first welded-edge hack saw blades . . . guaranteed them to be shatterproof . . . and a new concept of power hack sawing came into existence.

In combining, by welding, two materials—a narrow, high speed steel cutting edge, and a tough alloy steel body, MARVEL pioneered the modern hack saw blade.

When operators learned they could apply the heaviest feed pressures and highest speeds to the new MARVEL Blades with complete confidence that they would never shatter or "explode" to cause them personal injury, hack sawing began the approach to its present high level of efficiency. Even cutting "exotic" metals, such as titanium, where heavier feed pressures are a necessity, the MARVEL Blade does an outstanding job and is completely safe.

Today's MARVEL High-Speed-Edge Hack Saw Blades are greatly improved, even over the MARVEL Blades which were the best on the market a few years ago. Advanced metallurgy has produced better steels; new heat treating and manufacturing techniques have brought further improvements. The only thing unchanged is the Guarantee: THEY ARE SHATTERPROOF!

If you haven't used MARVEL High-Speed-Edge Hack Saw Blades recently, try them on your saws for a month and see the difference a truly superior blade can mean in higher speeds, greater accuracy, lower cost per cut, and guaranteed safety to operating personnel. Your nearby MARVEL Distributor carries a complete stock of MARVEL High-Speed-Edge Blades.

Write for Bulletin CT-175 which has complete details on MARVEL High-Speed-Edge Hack Saw Blades.

ARMSTRONG-BLUM MFG. CO.
5700 W. BLOOMINGDALE AVE., CHICAGO 39, ILL.

MARVEL *Metal Cutting* SAWS
Better Machines–Better Blades

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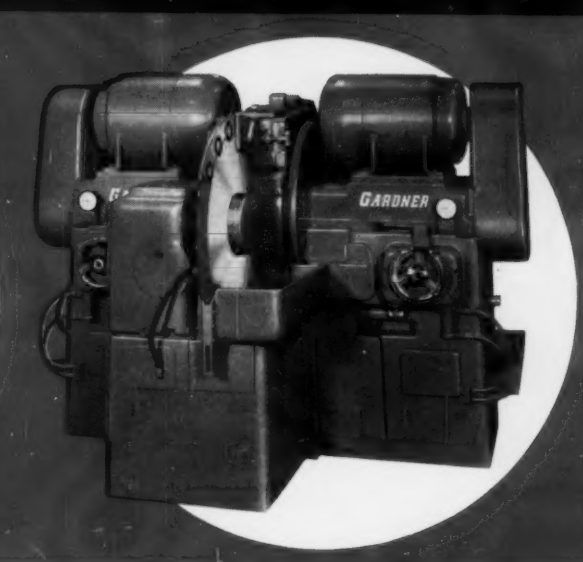
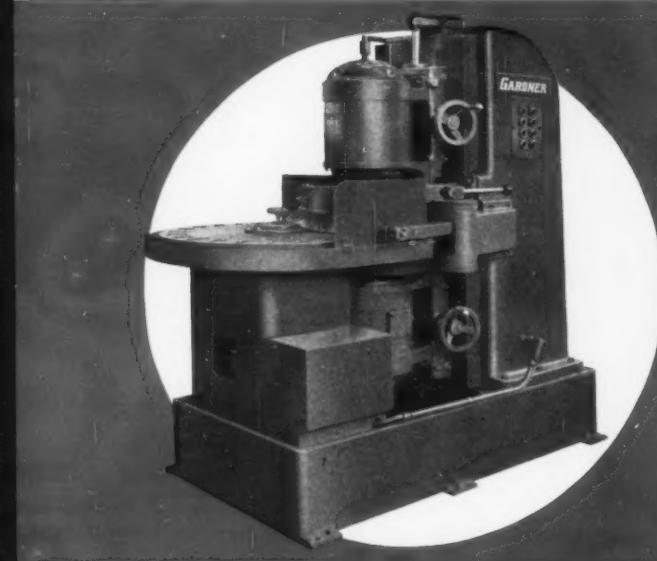


Single Spindle Disc Grinders—For production grinding single surfaces. Manual and power-operated work-carrying fixtures available.

Precision Double Spindle Disc Grinders — Grind TWO parallel surfaces in ONE operation. Rotary, feed thru or gun type work fixturing.



Precision Vertical Double Spindle Disc Grinders— Grind TWO parallel surfaces in ONE operation. Springs and miscellaneous small parts for watches, business machines, electronic applications . . . metallic and non-metallic materials.

Special Purpose Disc Grinders—For parallel surfaces, sequence grinding, generating curved surfaces . . . single or multiple surfaces.

a full line of precision disc grinders for high production, high quality flat surfacing . . .

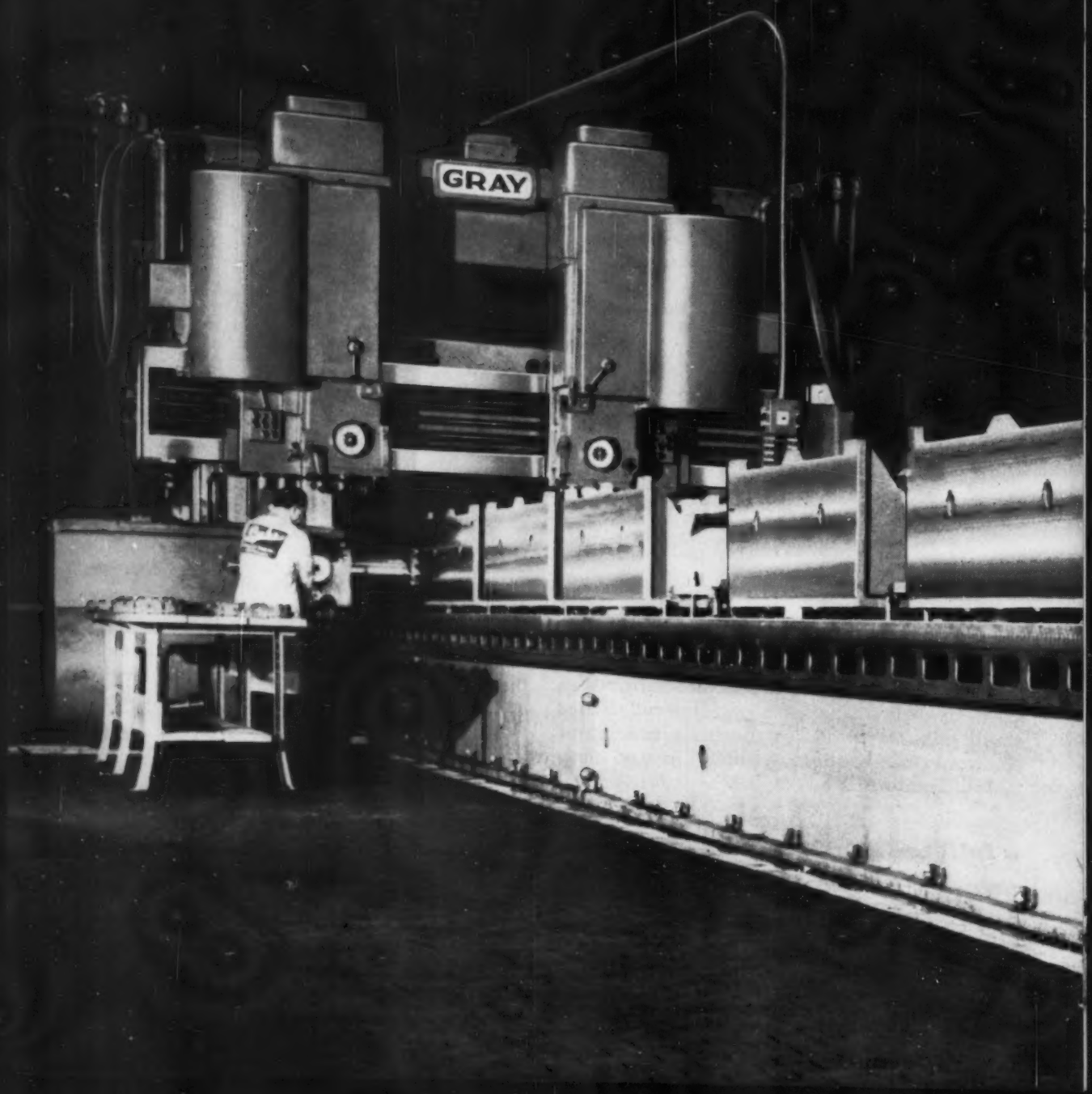
For information send for Condensed General Catalog

GARDNER

precision disc grinders

BELOIT, WISCONSIN

progress starts

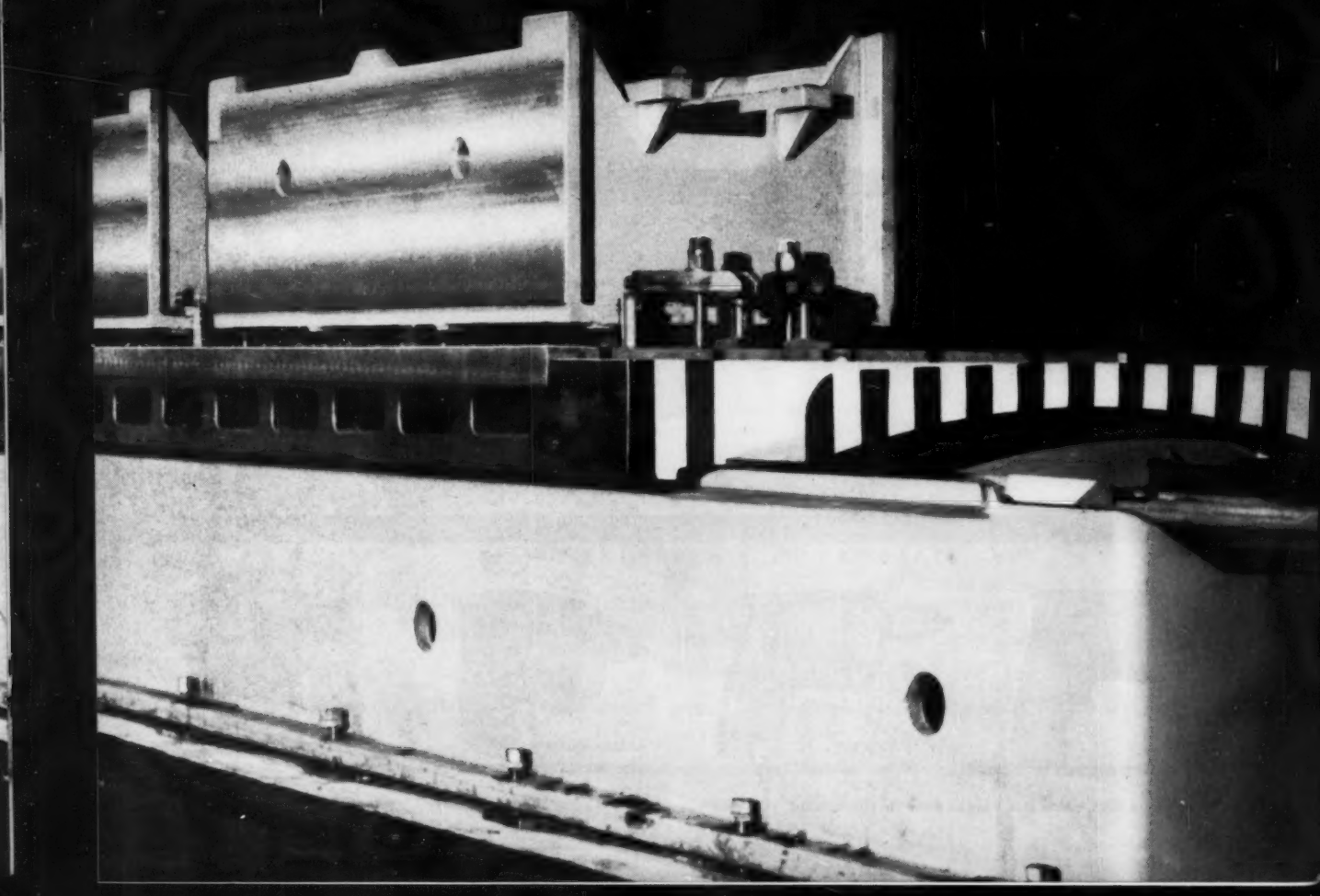


on a GRAY

What you see being milled on this big 105 foot long Gray, are transfer machine bases of the future...six at a time...automation production machines of Buhr Machine Tool Co., of Ann Arbor, Michigan. It's logical that this company, engaged in producing cost cutting, time saving equipment, should select a cost cutting, time saving Gray to do the job.

Gray unit head planer type millers dominate the field of modern heavy duty milling. This 66" x 66" x 50' giant can simultaneously deliver 300 H. P. to its four cutters. Duplex tables virtually eliminate idle time by permitting work set-up on one section, while work is being milled on the other section. Unusually simple control encourages maximum operator efficiency. All this, plus mirror smooth surfaces milled to precise tolerances maintain the Gray reputation for top quality the world over.

The G. A. GRAY Co., Cincinnati 7, Ohio



PET

Wodack

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Skil

33 GREAT MAKES

with ONE big feature in common–

Chicago Pneumatic

Buckeye

Ram

Wen

Aro

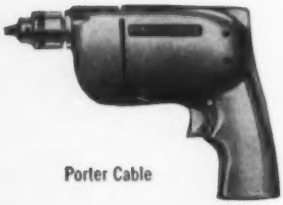
Milwaukee

Pioneer

Master Pneumatic

Sioux

Millers Falls



Porter Cable

Sunbeam

McGraw-Edison

Ward's Powr-Kraft

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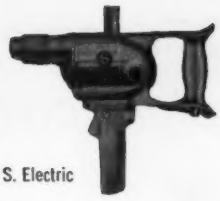
Black & Decker

Gibraltar



U. S. Electric

Ingersoll Rand

Stanley

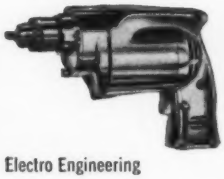
Jacobs CHUCKS

Thor

Rotor

Thor-Speedway

Dormeyer



Electro Engineering

Sears' Craftsman

Keller

Cleco

Air Speed

Cummins

A PARTNERSHIP IN PROGRESS

Your industrial supply distributor makes it his business to know your business. He is always available and ready to fill your needs quickly, dependably and economically. When you need chucks, you can depend upon Jacobs and the Jacobs industrial supply distributor who works with you . . . your partner in progress through service.

INDUSTRIAL DISTRIBUTORS · SERVING INDUSTRY ECONOMICALLY · THE RIGHT HAND OF PRODUCTION

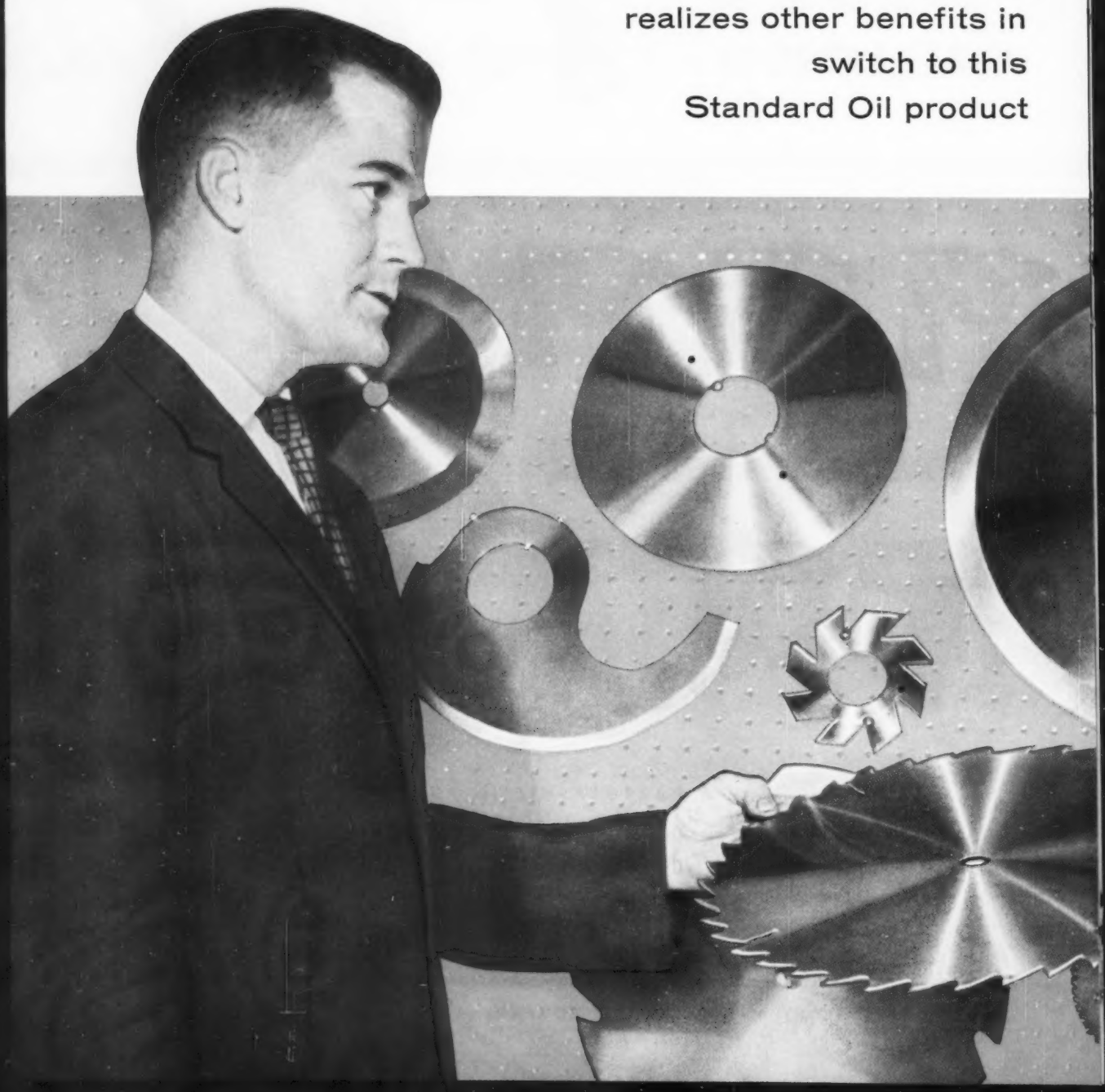
THE JACOBS MANUFACTURING COMPANY, WEST HARTFORD, CONNECTICUT

Gets 40% savings in coolant costs by change to

Standard's Transparent Coolant

ARGON Oil No. 4

Chicago Saws, Inc., realizes other benefits in switch to this Standard Oil product



Situation: It all started when a Standard Oil lubrication specialist recommended ARGON Oil No. 4, Standard's transparent coolant to Chicago Saws for use in their grinding operations. This manufacturer of rotary saw blades decided to give it a try. They knew the product was the result of more than three years' work in Standard's research laboratory, and that it had been extensively field tested.

What happened: Using ARGON Oil No. 4 in 100:1 concentration, Chicago Saws was able to reduce coolant costs 40%. They also found the work could be seen more clearly when using this coolant. There was less wheel loading. They also discovered the coolant didn't foam and that its exceptional ability to carry off heat resulted in cooler operation. Faster cuts were obtained with finer wheels. Tolerances were easier to hold. Better finishes were obtained. Wheel dressings were less frequent.

What you can do: Get more information about ARGON Oil No. 4 transparent coolant. Call the Standard Oil lubrication specialist near you in any of the 15 Midwest or Rocky Mountain states. Or write: **Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Ill.**

Using ARGON Oil No. 4, Chicago Saws gets better finish at savings of 40% over other coolants tried. Operator is using .004" cut on heat treated Rockwell 60 C steel.

You expect more from **STANDARD** *and you get it!*

Quick facts about

Standard's Transparent Coolant

ARGON Oil No. 4

- Clear, transparent fluid
- All chemical. Does not support bacteria growth
- Unaffected by humidity
- Nonfoaming
- Fire resistant
- Odorless

Standard's Bob Stark and Chicago Saws' vice president Paul Bostrom discuss blades and coolants. Bob Stark is well qualified to work with manufacturers on the use of metalworking coolants. Bob has a chemistry degree from Illinois College plus three years' experience at Standard. He has completed the Standard Oil Sales Engineering School course.

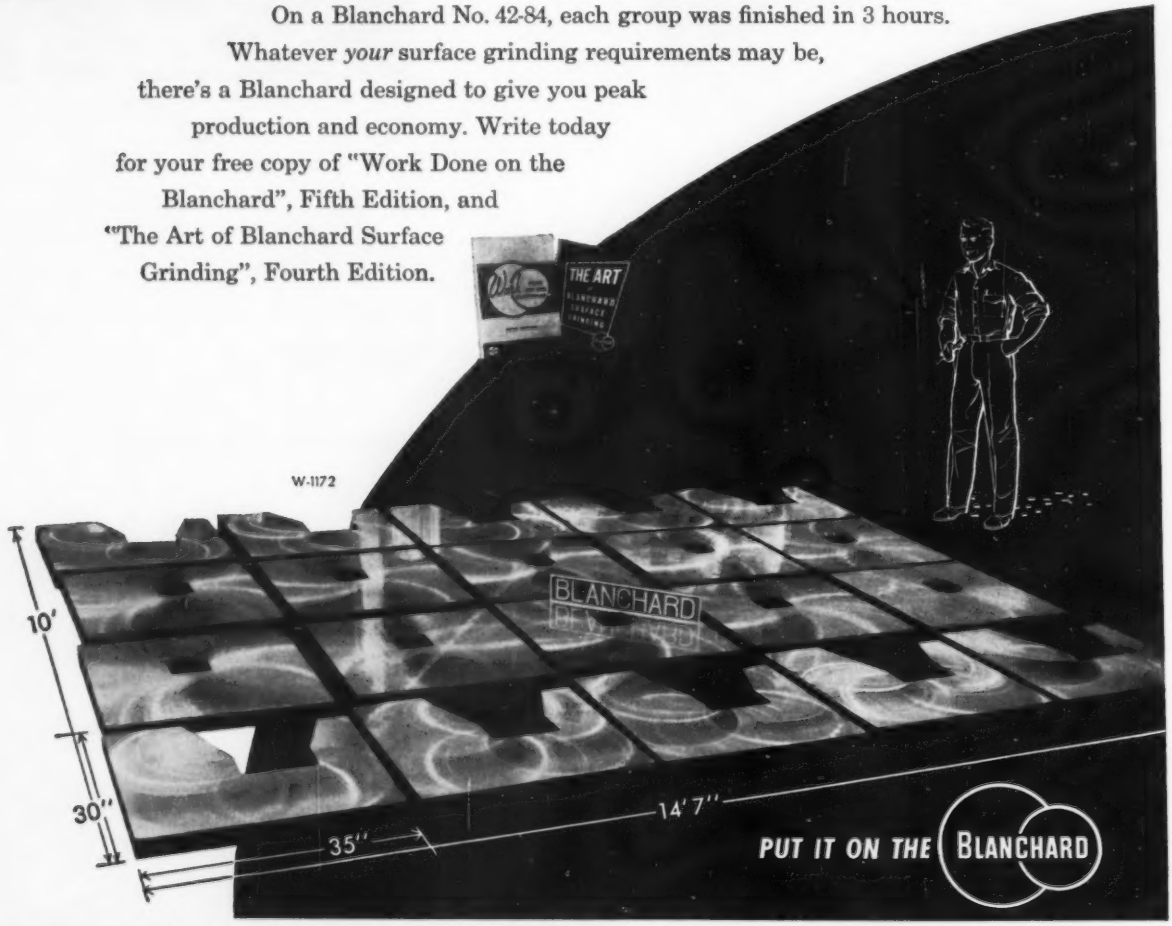
Grinding Perfection is Assured When You "Put it on the Blanchard"

V-517

The production speed and precision of modern Blanchard Surface Grinders are illustrated by this interesting job, involving 20 plates measuring 30″ x 35″ x 3″. Ten of them had openings of 6½″ x 4″, the other ten had openings of 11″ x 20″. Each group of plates required stock removal of 5/32″ from two sides, with flatness of .003″.

On a Blanchard No. 42-84, each group was finished in 3 hours.

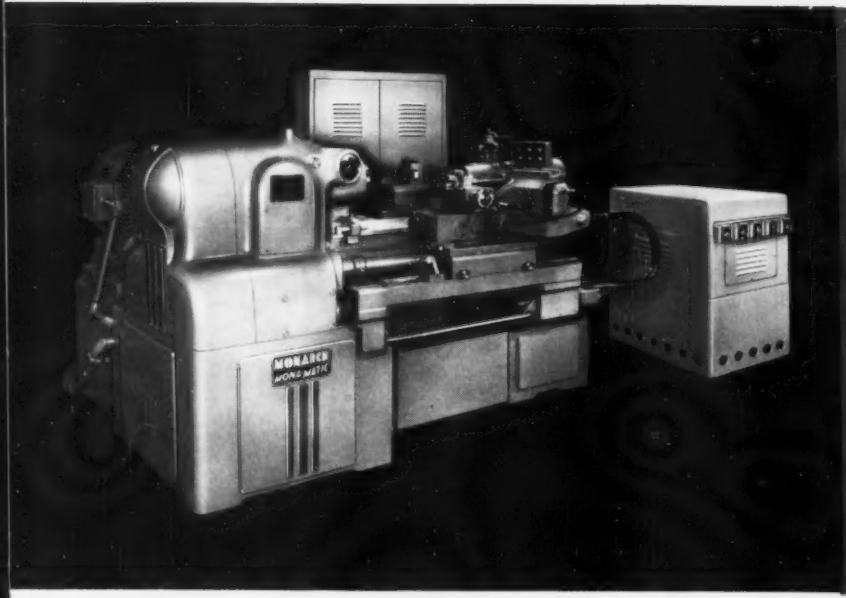
Whatever *your* surface grinding requirements may be, there's a Blanchard designed to give you peak production and economy. Write today for your free copy of "Work Done on the Blanchard", Fifth Edition, and "The Art of Blanchard Surface Grinding", Fourth Edition.



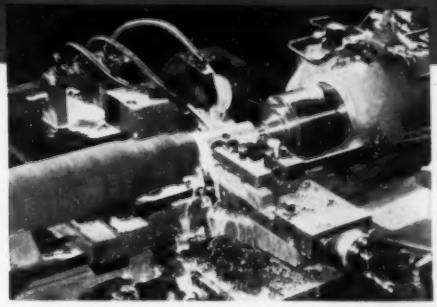
W-1172

THE BLANCHARD MACHINE COMPANY 64 STATE ST., CAMBRIDGE 39, MASS., U. S. A.

Don't Tool Up for Tomorrow's Boom with Yesterday's Lathes



MONARCH'S HIGH PRODUCTION LATHES OF TOMORROW...



Model 20-H Mona-Matic is available in 18", 30" and 42" center distance. Swing over bed is 15"; over front slide and rear slide ways, 8". Bed ways are flame hardened and ground.

4..The New Model 20-H Mona-Matic—A Low First Cost Production Lathe

Take a good look at what we've done to the Mona-Matic concept of production turning. This new machine

(1) *Carries a low price tag, because of simplified design*

(2) *Has fast hydraulic feed and traverse movements, making it exceedingly productive*

(3) *Is a dependable day after day performer, requiring only routine maintenance for years of trouble-free service*

The Model 20-H is a fully automatic double carriage turning machine, with a 60° "Air-Gage Tracer" controlled front tool slide. A variety of automatic cycling arrangements provides high productiveness and versatility. Eight spindle speeds are available by pick-off gears in each of three standard ranges. The tailstock has an air actuated spindle and inbuilt, heavy duty, anti-friction center.

Front carriage feed rate is infinitely variable from 1" to 40" per minute; traverse is 200" per minute. Rear slide feed rate is ½" to 40" per minute while traverse is at 90" per minute.

Four different feeds are available to the carriage. Either a one or a two cut cycle can be furnished. Two cut cycle machines are provided with a selector switch for one or two cut operation.

Imagine better performance at lower cost these days! Why not let us set up a demonstration on your parts? *The Monarch Machine Tool Company*, Sidney, Ohio.

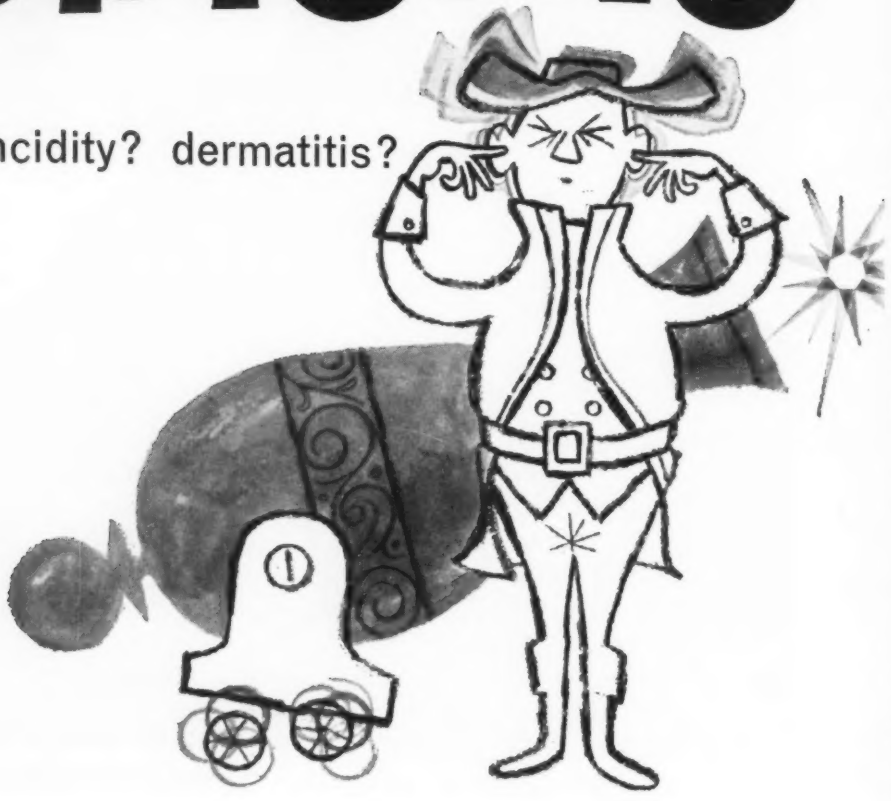
Monarch TURNING MACHINES

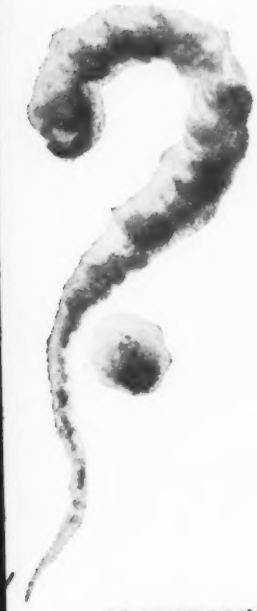
IF IT CAN BE TURNED, THERE'S A MONARCH TO DO IT BETTER AND FASTER

For more data, circle this page number on inquiry card

coolant problems

rust? rancidity? dermatitis?





Cold Stream stops rust resists rancidity reduces causes of dermatitis These problems start when your coolant gets dirty. Cold Stream stays clean week after week—even on cast iron. Cold Stream gives longest tool life. Finest finishes. Highest speeds and feeds. Best dimensional control. Cold Stream gives you everything you ever expected in a coolant!

JOHNSON'S

cold stream

Stays clean week after week and gives you all the performance you pay for.

JOHNSON'S WAX

For information, see your local Johnson industrial distributor.

"Cold Stream" and "Johnson's" are trademarks of S. C. Johnson & Son, Inc., Racine, Wisconsin

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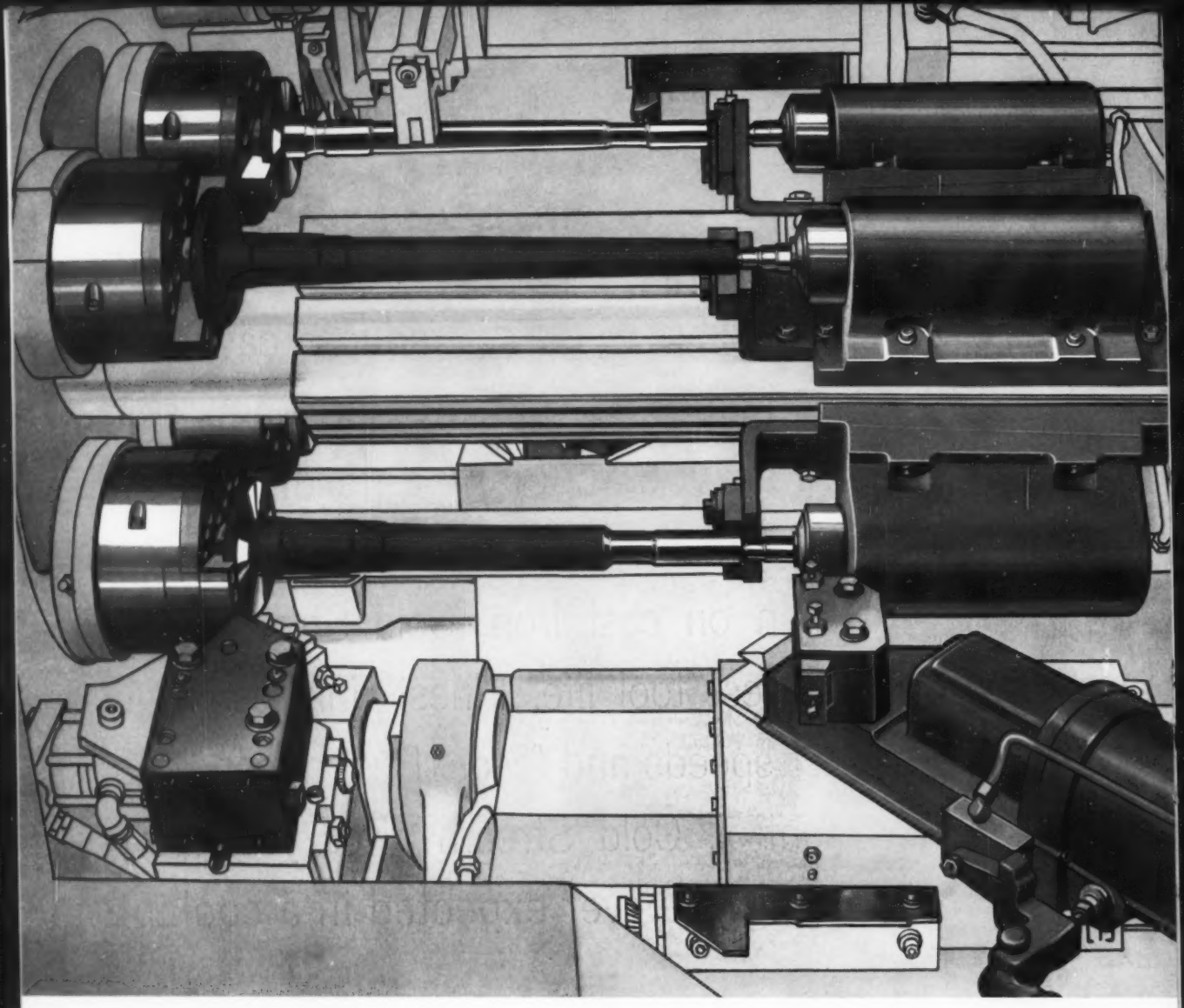


idea *for volume producers of shafts*

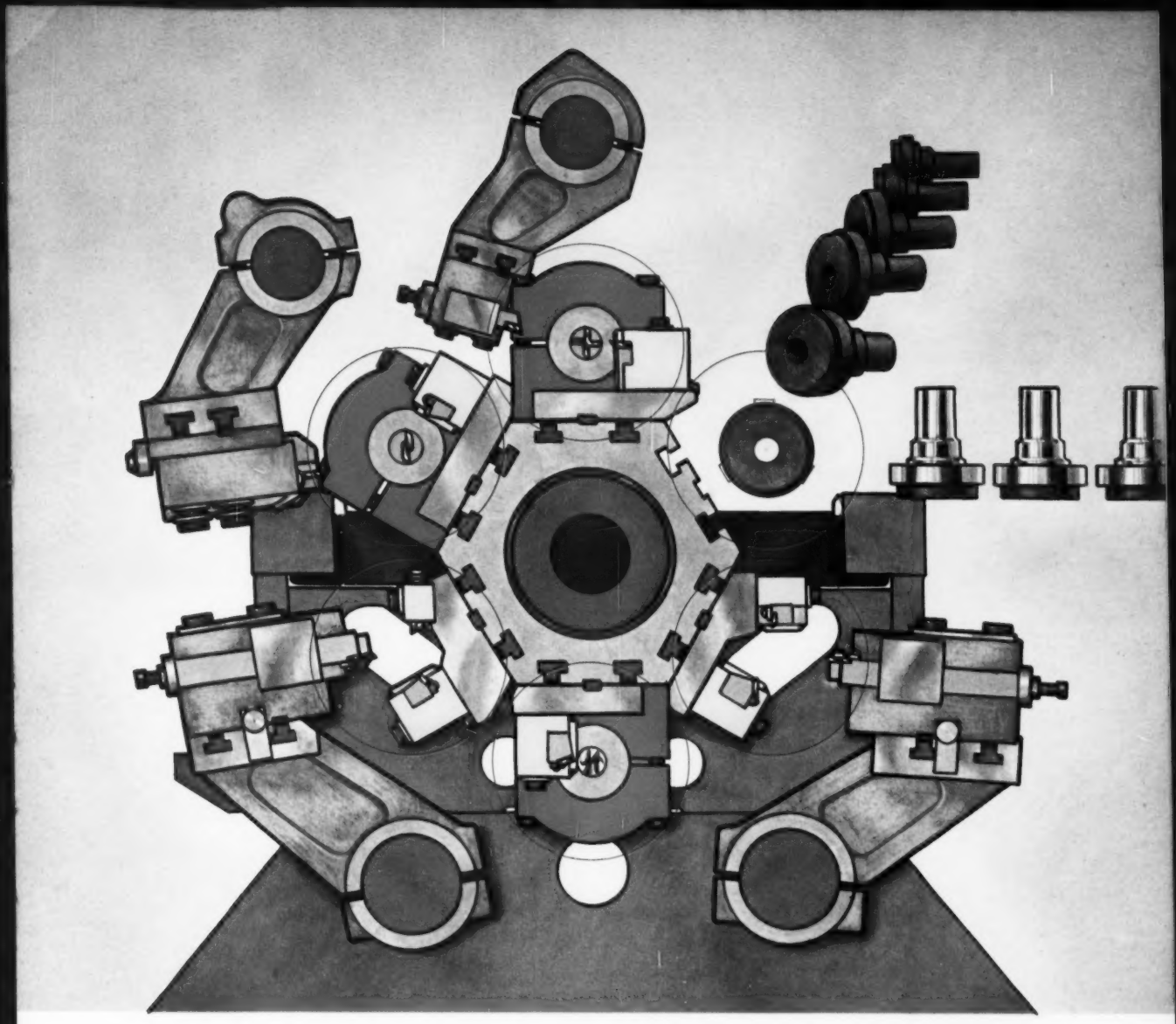
Economists are making startling predictions on this year's increase in productivity. They say it will be twice that of recent years – up as high as 10% in some manufacturing industries.

Whether or not these predictions come to pass, it's certain that it won't happen in plants using outdated equipment.

Shaft work is a problem to many firms. New Britain pioneered template-controlled contour turning and boring, solving the problem for many progressive companies. Now for the manufacturer with really high volume requirements we present Model 412/25–a four-spindle, template-controlled machine capable of producing a four-fold increase in productivity per man hour.

The basic principle pretty much speaks for itself. As in the case of the single-spindle contour lathe, inexpensive metal templates control the full cycle and re-cycle if required. Simple, single-point tools replace complex gang tooling. Set-up is simple and fast. When tools wear, merely replace them. Since all relationships are maintained by the template, tool replacement involves no problem.

When the volume of contour turning warrants it, this machine can be the best money maker on the production floor. Your New Britain representative can quickly tell you after looking at your prints and learning of your production requirements. Meanwhile, we would be glad to mail you descriptive literature containing the basic facts and specifications. New Britain-Gridley Machine Division, The New Britain Machine Company, New Britain, Connecticut.



two *approaches to the depreciation problem*

Until there is relief in the form of a more liberal tax depreciation policy, there's only one way to avoid the pinch of a shop full of over-age machines you can't afford to replace: *Buy machines that will stay new.*

If you are a user of New Britain chuckers you have seen their basic principles continue to stand as the most advanced design available, year in and year out.

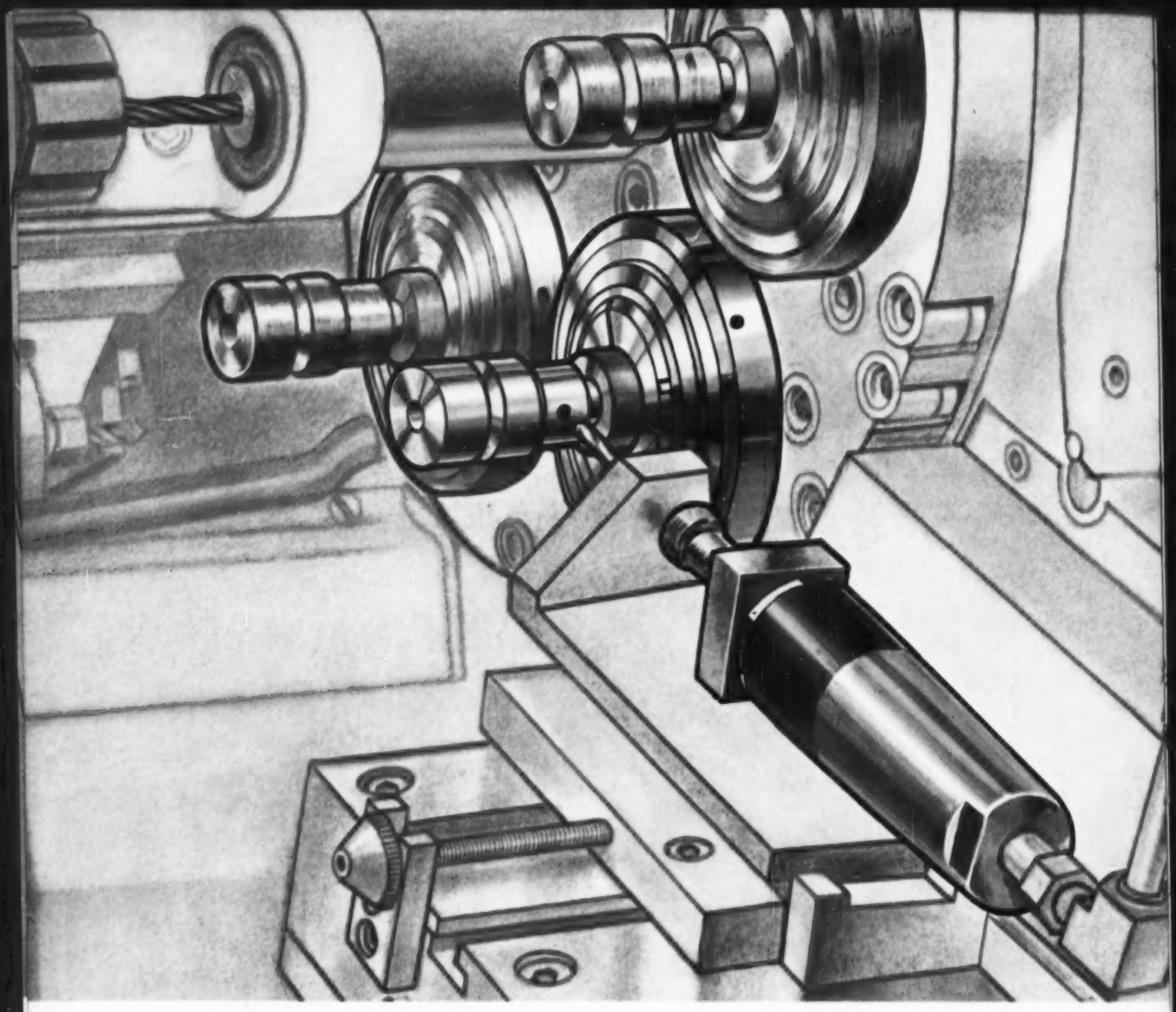
What value do you place on lifetime machine accuracy? The spindle carrier is the heart of a chucking machine. On a New Britain the carrier is lifted during index so it can't wear—then positively clamped to the frame during the cutting cycle for accurate cutting.

Interested in heavy facing and forming cuts? The long established New Britain swinging forming arm feature remains the best answer.

Want maximum clearance for fast and easy tooling, adjustment, and chip removal? Only New Britains are built with open end construction.

Today's New Britain chuckers provide the spindle speeds and power to take advantage of the most modern cutting tools. Optional tooling equipment includes drill speeders and attachments for reversing and non-reversing threading, recessing and accelerated reaming.

A new catalog describes the full New Britain line of 4-, 6- and 8-spindle, open-end, chucking machines. Fully illustrated in color, showing actual jobs, it may well suggest ideas for doing your work. Write for your copy. New Britain-Gridley Machine Division, The New Britain Machine Company, New Britain, Connecticut.



1960 productivity **now**

If you have a voice in the purchase of machine tools you have probably begun to think in terms of what will be on exhibit at next year's Machine Tool Show.

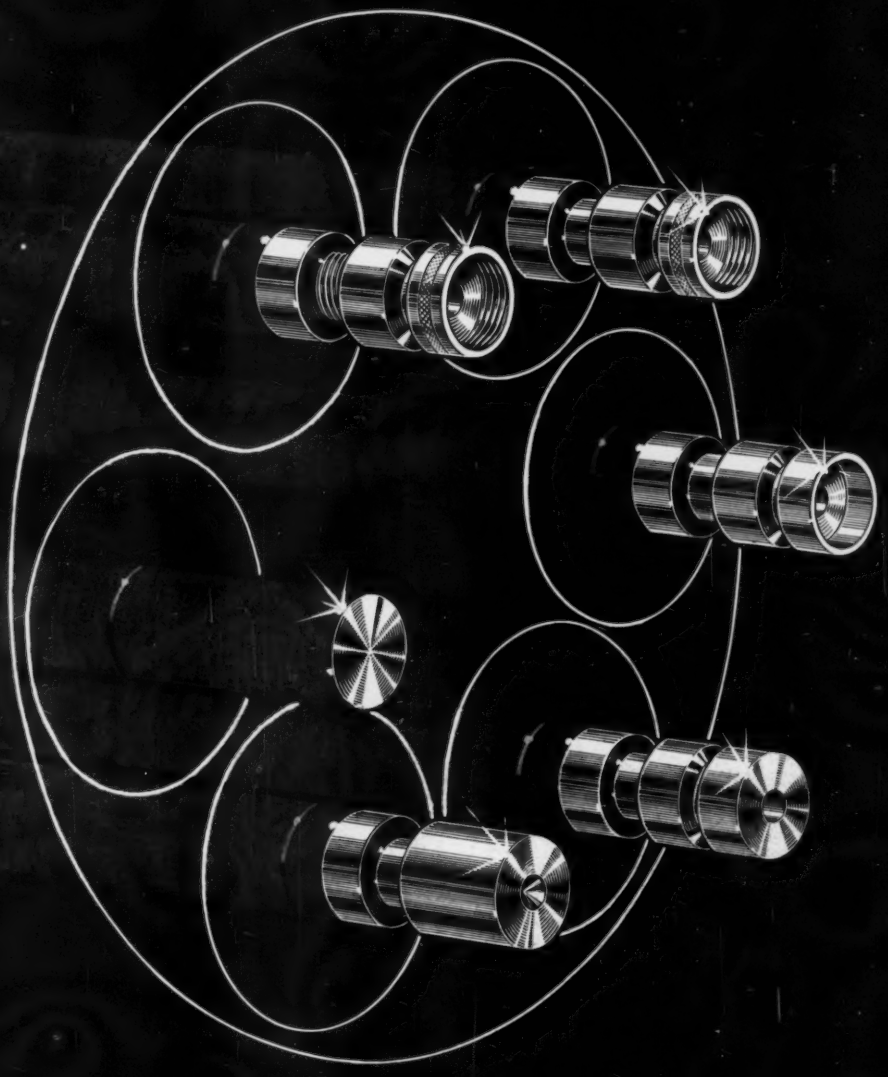
As far as multiple spindle bar work is concerned, you can see and buy and profit from the "show year" developments of New Britains a year ahead of time.

More operations, more pieces per hour, at closer tolerances has been the demand for years. Now New Britain has brought out a complete new line of bar machines that gives these words a brand new meaning.

Take the new Model 45 4-spindle series. The spindle capacity of 5" puts much larger pieces within automatic high-speed bar machine production range. Cross slides in all positions greatly increase the number and variety of cuts possible on four spindles. Spindle speeds up to 526 RPM provide for the use of the latest cutting tools. At the other extreme is a new line of 8-spindle machines. As you would expect with New Britain's radial independent cross slides, you can apply a tremendous number of tools and attachments to get very high production on really complex pieces. Or, with a double indexing setup, you can turn out pieces, even pretty complex ones, at an all-time high rate per hour.

Six-spindle machines are everybody's work horses and New Britain offers the Model 52 in the 1¾" range, and the Model 62 with 2¼" capacity. These machines allow you to use a greater number and variety of tools on them without sacrificing accessibility. They can be tooled quickly and you can get at the tools for changes or adjustments with ease.

We can only suggest here some of the "show year improvements" in a greatly expanded line of New Britain bar machines. Your New Britain representative will be glad to arrange for a demonstration, and secure performance data based on your prints. If you would like to look over a catalog first, we'll be glad to send you complete descriptive literature. New Britain-Gridley Machine Division, The New Britain Machine Company, New Britain, Conn.



3½"—More **capacity** *than ever in a New Britain*

Model 82 • Six Spindles • 3½" Capacity • All New

Here is a *brand new* New Britain . . . the most modern large capacity bar machine available. The Model 82 brings to the 3½" size range all the versatility and exclusive New Britain features previously available only on smaller models. Designed from the ground up for large capacity work, the Model 82 is the only 6-spindle machine on the market that offers a really up-to-date replacement for the older, slower methods currently used for this size range.

Each of the six spindles on the Model 82 has an independent, cam-operated cross slide. These cross slides combined with the end-working tool slide allow practically unlimited tooling combinations.

The Model 82, like all New Britain Bar Machines, has a special lifting and locating mechanism which prevents wear on the spindle carrier. Rigid locking of the carrier to the massive frame during the cutting cycle eliminates vibration.

The power, massiveness, speed range, accuracy, ease of changeover, coolant capacity and every other feature designed into the Model 82 makes this the right machine for high-precision, high-production, large-capacity bar work.

Why not investigate the possibilities the Model 82 offers in your plant? When you get right down to it, it's the first chance you've had in a long time to update production in an area that needs it badly. Complete catalog material is available on the whole range of New Britain Six Spindle Bar Machines. For your copy, write to The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Conn.

This card assures you *on-time delivery* of sub-contract components and assemblies

It's a small but important part of TMW's electronic punched card scheduling and control system. And it's your assurance that sub-contract jobs, regardless of size or quantity, are delivered *on time*.

You get this when you work with one of the world's largest, most modern and completely integrated manufacturers, whose 65 years' experience in precision (tolerance to 10ths) manufacturing is available to you *now* on either a short or long term basis.

Textile Machine facilities include 1200 modern machine tools of all types and sizes, a completely mechanized foundry (one of the country's largest), 3000 skilled craftsmen, plus a corps of the industry's top designers and engineers.

Combine these facilities with modern electronic production scheduling controls and quality control techniques . . . and you've got the perfect answer to all your sub-contract problems.

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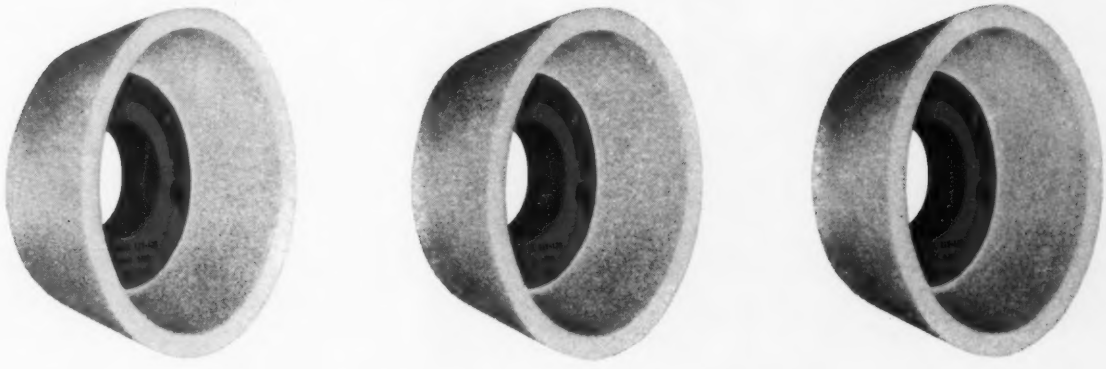


Each of these gyroscopes positively duplicates the built-in balancing action of every other gyroscope.

And *balance built-in* is an important advantage you get with the toolroom cup wheels shown above, and with *all* CINCINNATI (PD)° GRINDING WHEELS. They are manufactured by a remarkable process that gives Positive Duplication, time after time after time.

With every step of manufacturing rigidly controlled, this unique (PD) process produces wheels of unsurpassed uniformity. One important result: balanced action for a safer job . . . a better job.

When you reorder a CINCINNATI (PD) WHEEL, it will act and grind exactly like the original, helping you maintain production, saving time and money. Whatever shape, grade and size you specify . . . centertype, centerless, internal, surface, toolroom or snagging wheel . . . you get Positive Duplication — every time!

Our factory representatives are trained specialists, experienced in grinding job set-ups and operations. For their help on those extra-tough grinding problems, call your CINCINNATI (PD) GRINDING WHEEL distributor, or contact Cincinnati Milling Products Division, Cincinnati 9, Ohio.

(PD) POSITIVE DUPLICATION

CINCINNATI®

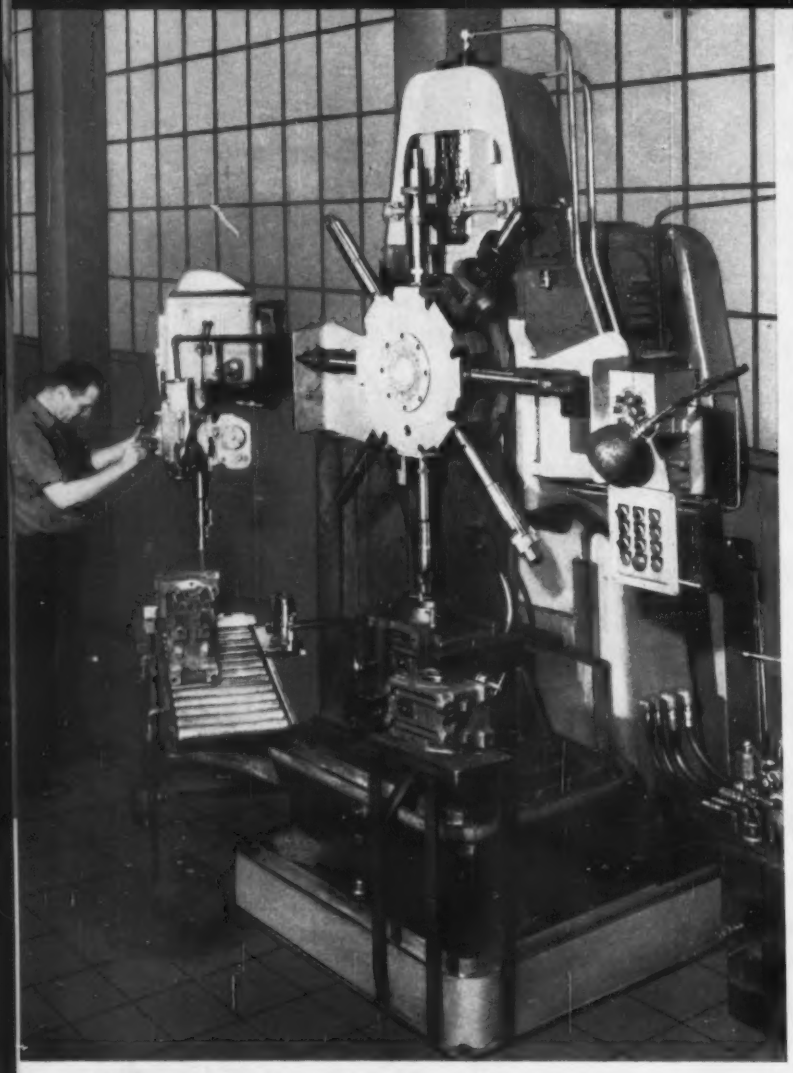
GRINDING WHEELS

A PRODUCTION PROVED PRODUCT OF THE CINCINNATI MILLING MACHINE CO.

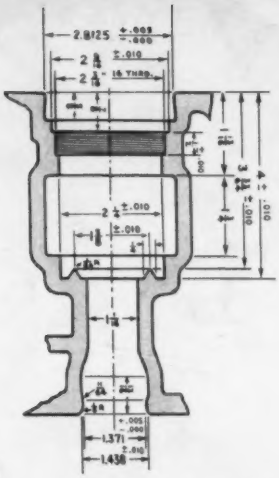
For more data, circle this page number on inquiry card

"AB" Pipe Bracket Production

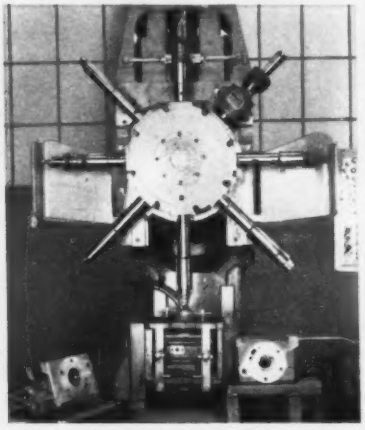
BURGMASTER automatic hydraulic



One man conveniently runs the automatic hydraulic Burgmaster and also drills and taps 3 holes on the small radial drill nearby. Production is increased 100%.



Cast iron "AB" Valve Pipe Brackets showing 15 machining operations performed on the Burgmaster 8 Spindle Turret Drill. Production was increased 200% over former turret lathe operation.



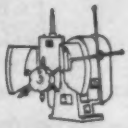
Close-up showing large multiple carbide tipped boring tools and special 180° indexing fixture. Valve parts are now machined in .1760 hours instead of .3562 hours—increasing production 100%.

Specialists in High Production Turret Drilling

"O" Manual Power Index ¼" Capacity

1C Manual Power Index ⅜" Capacity

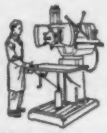
2B Manual Power Index ¾" Capacity



2BF Flange Mounted Power Index ¾" Capacity

2BH Automatic Hydraulic ¾" Capacity

3BH Automatic Hydraulic 1½" Capacity



2BR Ram Type Radial Drill ¾" Capacity

2BHT-3BHT Automatic Tape Controlled ¾" and 1½" Capacity

Increased 100% with...

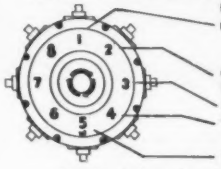
8 SPINDLE TURRET DRILL

(at Canadian Westinghouse Co.–Air Brake Division)

Good tooling that takes advantage of the powerful Burgmaster 3 BH 8-Spindle Automatic Hydraulic Turret Drilling Boring and Tapping machines is increasing production on "AB" Valve Pipe Brackets 100% at Canadian Westinghouse Co., Air Brake Division, Hamilton, Ontario. 15 precision operations are automatically performed in 10.5 minutes including core drilling 2-15/16, forming 2.8125", tapping 2⅜"-16, reaming 2.781, and under cutting. Formerly these parts were machined on a turret lathe in 21.4 minutes. The parts are held in a 180° indexing fixture and 5 of the Burgmaster spindles are used for the first sequence of operations. During this time the operator drills and taps two ⅜-16 threads, and one ⅜-18 pipe thread on a small radial drill. Burgmasters are pace setters, automatically doing the work and the thinking,–requiring only loading, unloading, and starting by pressing a button.

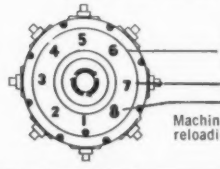
Burgmasters are field proven machine tools that produce efficiently because of the automatic hydraulic machine functions. The turret is power indexed, permitting skip indexing and selecting the desired spindle. 20 speeds may be supplied ranging from 20 to 1700 rpm, which are pre-selected and automatically shifted for each spindle. Feeds are infinitely variable and pre-selected for each spindle. Adjustable micro-depth stops and adjustable control for rapid traverse to and from the work are provided for each spindle to save valuable machine time and speed machining cycles. As a result all operations are performed at the most efficient rate commensurate with fine finish, accuracy, speed and longest tool life.

HOW THE JOB IS RUN . . .



Operation (first end)	Diameters	Speed	Feed
Core Drill, Form Radius	2 15/16, 2 3/8, 2 1/4	115	.011
C'Bore, Trepan, Form Seat	2 1/4	115	.010
Finish Ream	2.781	375	.015
Tap	2 3/8-16 thread	120	.062
Form Taper, Under Cut	2 3/4	230	.015

Machine Indexes to #6 Spindle and stops in up Position.
Note: Operator Drills and Taps two ⅜-16 threads and one ⅜ pipe thread on a radial drill during this portion of the automatic Burgmaster Cycle. Fixture is now indexed 180°–Press Button to start machine.



Operations	Diameter	Speed	Feed
Rough Ream, Form Radius	1 3/4	375	.020
Under Cut	2 3/4"	230	.015
Finish Ream	1.371	375	.020

Machine Indexes to #1 Spindle and stops–ready for reloading.

Maximum Flexibility is assured–because all machine functions are adjustable, the machine can be set up with different tools and fixtures in approximately one to one and a half hours to produce other parts–automatically.

Burgmasters may be supplied as complete production units, including fixtures and tools ready to go into production. Manufacturers are finding they may be tooled to replace many different types of machines to effect substantial savings, increase production, and cut costs. Why not ask a Burgmaster field engineer to make recommendations on your work? There is no obligation.

Job Facts .....

Company: Canadian Westinghouse Co., Air Brake Division

Machine: Burgmaster 3 BH Automatic Hydraulic Turret Drill

Part: "AB" Valve Pipe Bracket

Material: Cast Iron

Fixture: Special 180° Hand Indexing

Tools: Special Carbide–Multiple Cutting

Former Method: Turret Lathe

Former Time: .3562 hours

Present Time: .1760 hours

Production Increase: 100%

Other Advantages: Operator drills and taps 3 holes on a radial drill during Burgmaster Automatic Machining–Less Floor Space–Burgmaster can be readily tooled for other work when desired–no obsolescence.

Write for bulletin describing Burgmaster 6 and 8 spindle Automatic Hydraulic Turret Drills in detail. Twenty-minute 16mm sound film showing Burgmaster turret drills in operation, including the new automatic positioning table, available from any office.

BURG TOOL

MANUFACTURING COMPANY, INC.

15001 South Figueroa Street, Gardena, California

FAculty 1-3510 DAvis 9-4158

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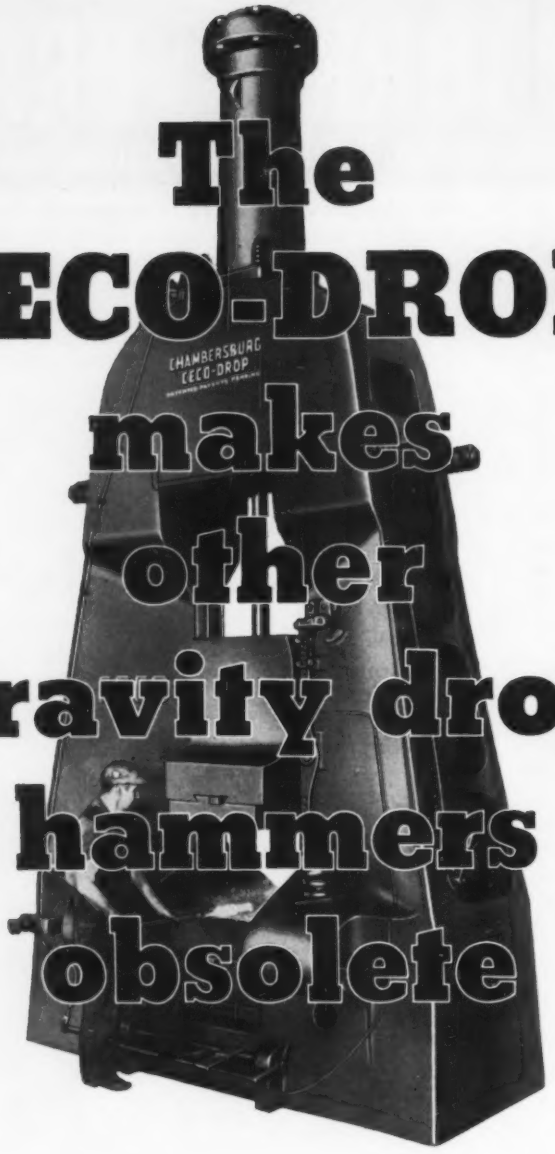
Plus dealer representatives in other industrial centers.

The CECO-DROP makes other gravity drop hammers obsolete



THIS is no mere slogan; it is a statement of fact. Since its introduction twelve years ago, the Ceco-Drop, in installation after installation, has proved its greater productive capacity and its economy over any other gravity drop hammer.

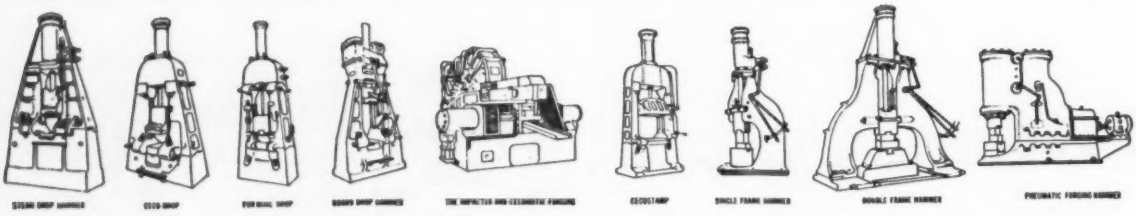
These are not unsupported claims. They are backed up by testimonials from users: like **"increased production over board drop between 10-20%"**; "die life on the Ceco-Drop is nearly double"; **"the first two Ceco-Drops have saved approx. $3000 each** in maintenance and boards in first year"; "after approx. 1200 production hours, one Ceco-Drop had total of less than 10 hours maintenance"; **"I would give a good deal if I had all of our board hammers out of the shop and nothing but Ceco-Drops"**; and hundreds of others.

To convince yourself, you should read Chambersburg's 28-page bulletin on Forge Shop Modernization.

Send for your copy today.

CHAMBERSBURG ENGINEERING COMPANY . . . . . CHAMBERSBURG, PENNSYLVANIA

CHAMBERSBURG • The Hammer Builders



FAculty 1-3510 DAvis 9-4158 *industrial centers.*

57-74

Specify Ex-Cell-O standard power units and cut your machine tool lead time

Today's demand for increased productivity, lower per-unit cost, even on relatively short runs, is being met economically by automatic, single-purpose, high-production machines—consisting essentially of a plain base and one or more Ex-Cell-O Quill-Type Hydraulic Power Units. Their flexibility allows them to be used over and over again, spreading their initial cost over many productive years.

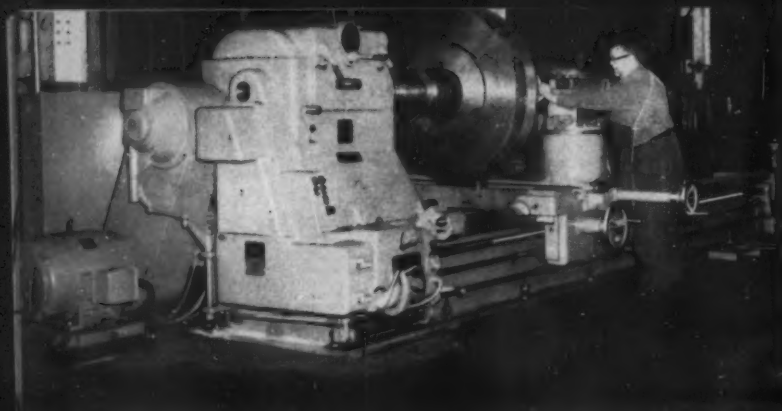
These standard, self-contained Ex-Cell-O Hydraulic Power Units are now being used for: drilling, counterboring, spot facing, reaming, as well as prime movers for milling equipment. With multiple spindle head attached to quill flange, multiple operations may also be performed.

For the full story on the cost-saving advantages Ex-Cell-O Self-Contained Power Units offer your short- or-medium-run production requirements—get in touch with your local Ex-Cell-O Representative. Or, if you prefer, write direct to Ex-Cell-O, Detroit.

***Style 22—8-inch Stroke; Style 22-L—12-inch Stroke**

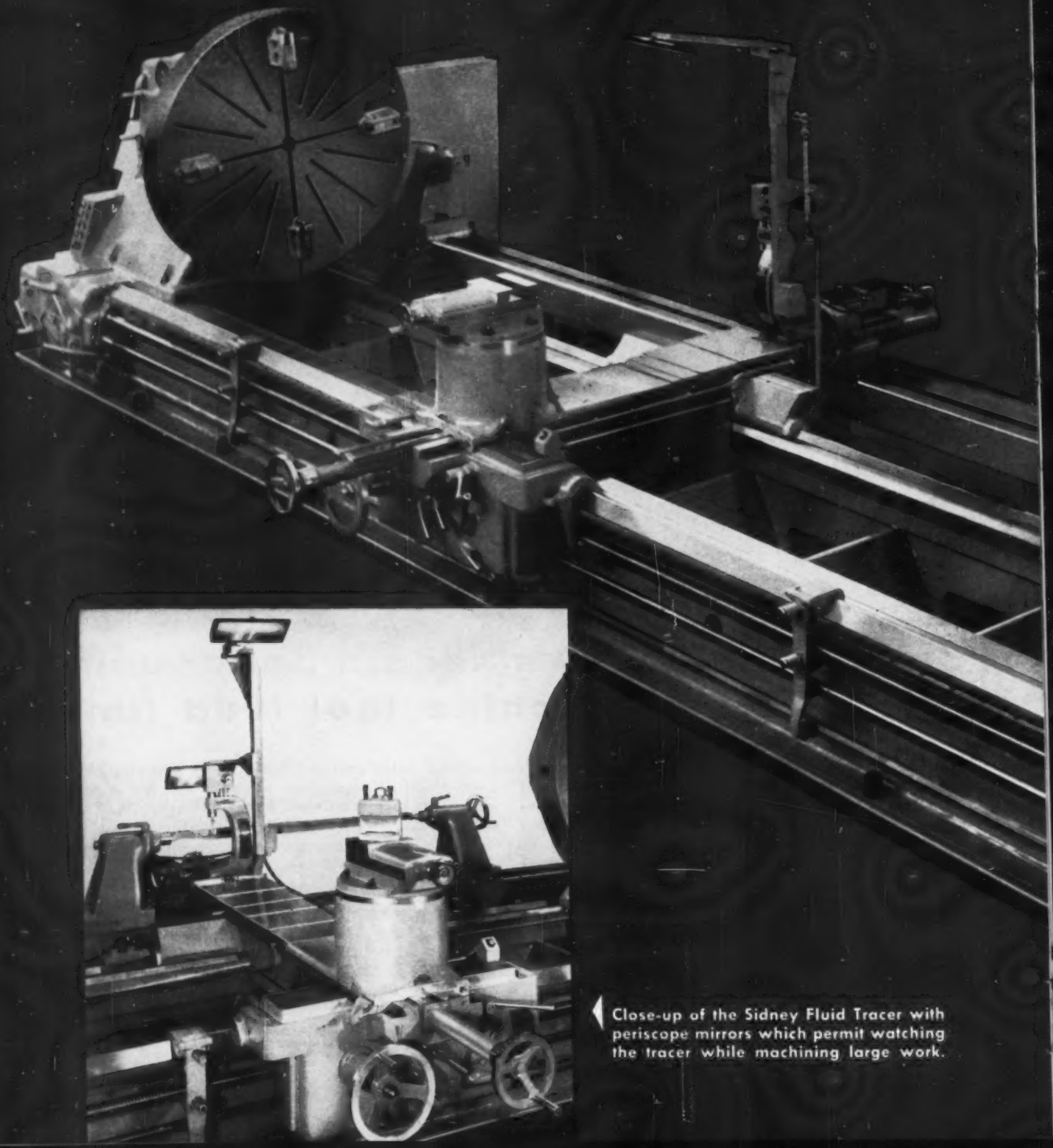
EX-CELL-O CORPORATION *Machinery Division*
DETROIT 32, MICHIGAN

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • TORQUE ACTUATORS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

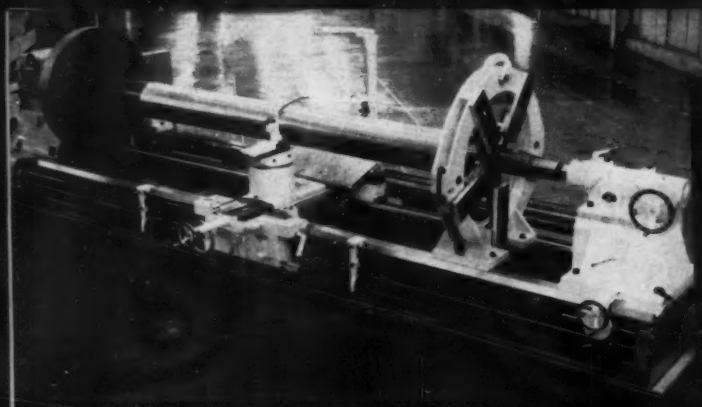


A large missile component being tracer-machined at a major West Coast missile plant on a Space-Master with 60" swing and 21' centers.

This Sidney Space-Master is contouring steel rolls up to 50" diameter to close tolerances.

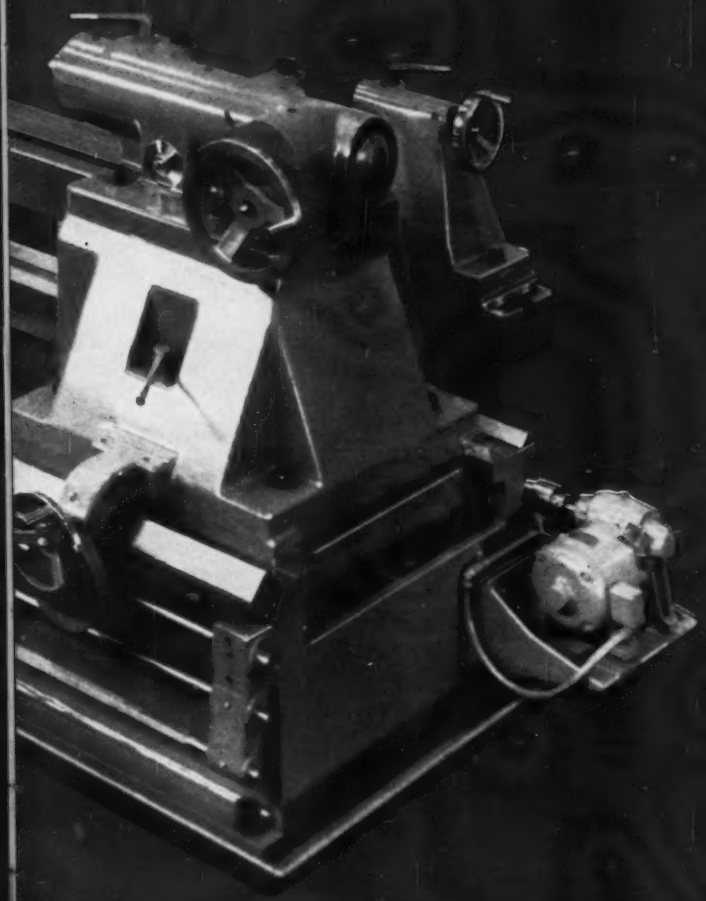


Close-up of the Sidney Fluid Tracer with periscope mirrors which permit watching the tracer while machining large work.



Introducing the SIDNEY SPACE MASTER©

for high precision on large parts



With swings up to 72 inches and center distances up to 51 feet, the Sidney SPACE-MASTER© is the answer for those manufacturers looking for precision on large MISSILE AND ROCKET PARTS.

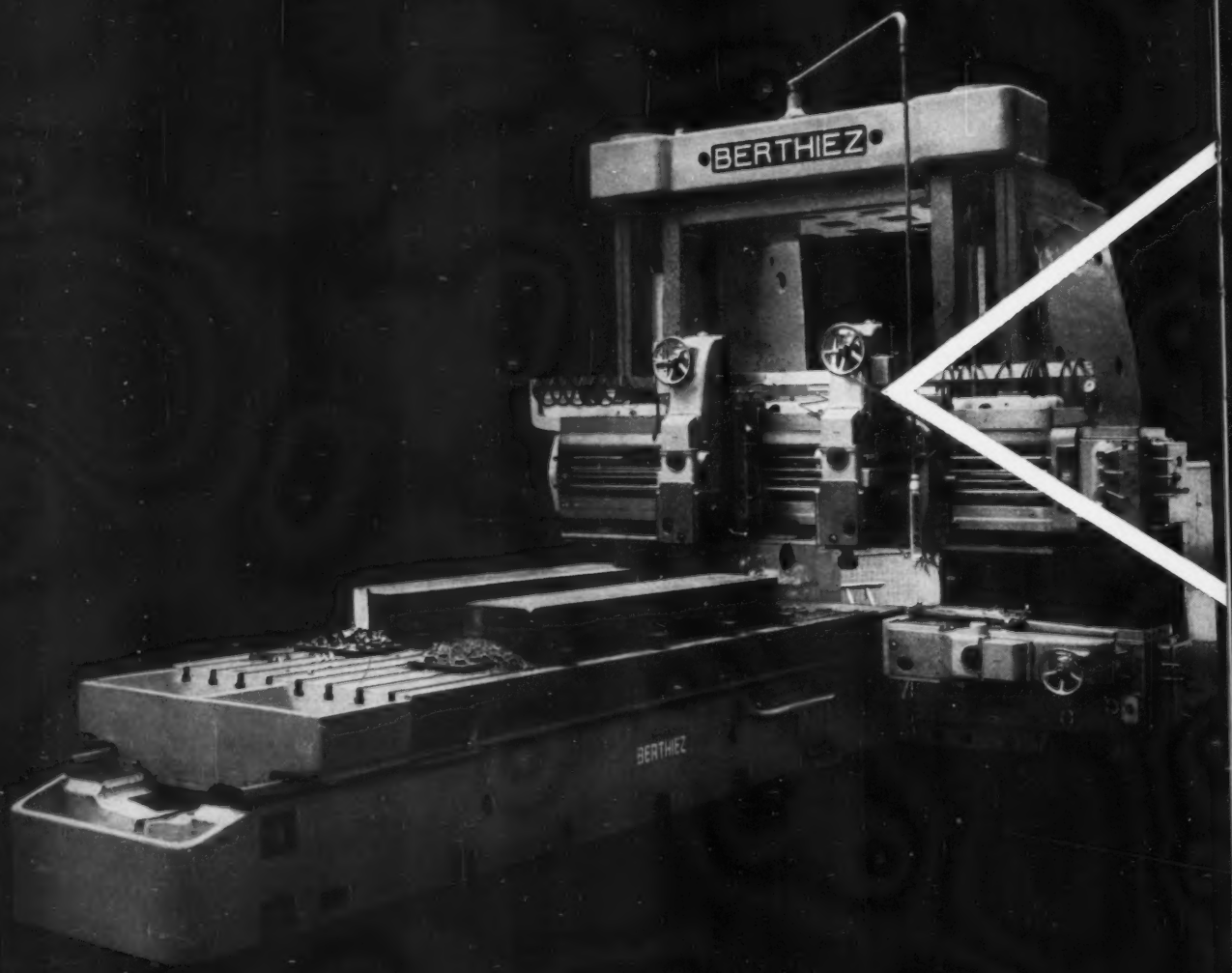
Available with or without the Sidney Fluid Tracer, the Space-Master is full of precision-insuring and time-saving features. Here are some of them:

- **Lapped herringbone gear headstock**
- **60 thread and feed changes**
- **Powerful rapid traverse**
- **Double-walled apron**
- **Massively bridged bed**
- **Large support areas throughout for carriage, slide, tailstock, etc.**
- **Heat-treated lathe rack**
- **Graduated dial to measure tailstock spindle travel**
- **Honed tailstock bore**
- **Anti-friction bearings**
- **Periscope mirrors for Tracer when machining large parts**

If you want to speed output, hold your tolerances down (to ± .001) and cut your cost, it will pay you to look into the Sidney Space-Master. Ask for Bulletin #S-600.

SIDNEY MACHINE TOOL CO.
SIDNEY, OHIO
Wholly owned subsidiary of Buhr Machine Tool Co.

BERTHIEZ has been
CUTTING BOTH WAYS,
COMING AND GOING for
the last 12 years
BERTHIEZ has been rough and finish
CUTTING BOTH WAYS with
multiple tools for the last 10 years

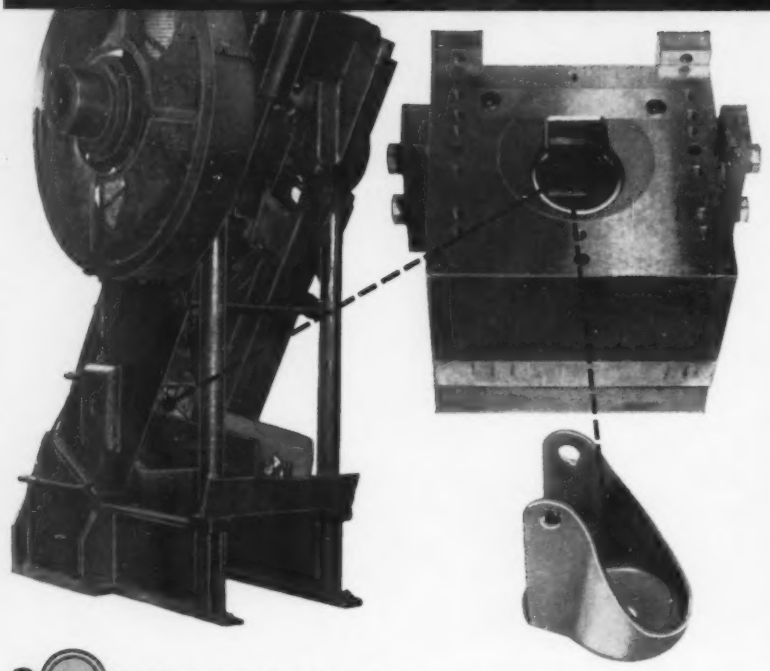


BERTHIEZ has supplied over 100 large Single and Double Upright Planers CUTTING BOTH WAYS, COMING AND GOING since 1946 which have been working year in and year out ON DOUBLE WAY CUTTING

BERTHIEZ

HEAD OFFICE, 5, RUE MONTALIVET, PARIS (FRANCE)

Talide® DIE IN SERVICE 8 YEARS DRAWS 9,000,000 CASTER PARTS!

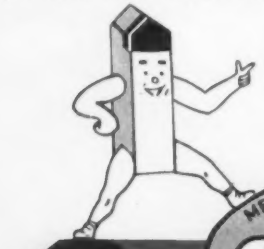


Bassick COMPANY, Bridgeport, Connecticut, leading producer of casters, chair controls, automobile and specialty hardware, was experiencing difficulty drawing an eccentric shaped chair caster part from commercial quality hot rolled drawing steel.

Scrap rate was high—production per die low. The high-speed steel die being used (costing $350.00) had to be reground and polished every 30,000 pieces, and replaced several times a year.

A Grade C-85 Talide die (costing $1100.00) was installed in 1950 and to date has produced over 9,000,000 caster parts. During this 8-year production run, the Talide die has required no servicing and is still in operation.

Bassick Company engineers report that the quality of their product has been improved. Surface marks and scratches, caused by scoring and galling of the steel dies previously used, have been completely eliminated.



A Talide die engineer can help you cut costs and increase production on draw presses, punch presses, pill presses, cold headers, swagers and draw benches.

METAL CARBIDES CORPORATION
6001 Southern Boulevard Youngstown 12, Ohio

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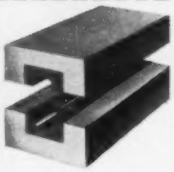
MC
TALIDE®
YOUNGSTOWN 12, OHIO

HOT PRESSED AND SINTERED CARBIDES • VACUUM METALS
HEAVY METAL • ALUMINUM OXIDE • HI-TEMP. ALLOYS
OVER 25 YEARS' EXPERIENCE IN TUNGSTEN CARBIDE METALLURGY

WIRE DIES

Hundreds of miles of steel and non-ferrous wire—.004 to .750—drawn through TALIDE dies.



SWAGING DIES

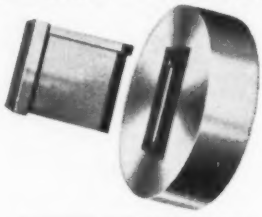
Leading fountain pen manufacturer cold swages 33 times more stainless steel parts with TALIDE dies.

HEADING AND EXTRUSION DIES

Cold heading ¼" C-1008 rivets, TALIDE dies produced 11,200,000 pieces, other carbide dies only 3,500,000.

CURLING ROLLERS

TALIDE curling rolls last 65 times longer than steel rolls on beverage can forming operation.



BLANKING AND FORMING DIES

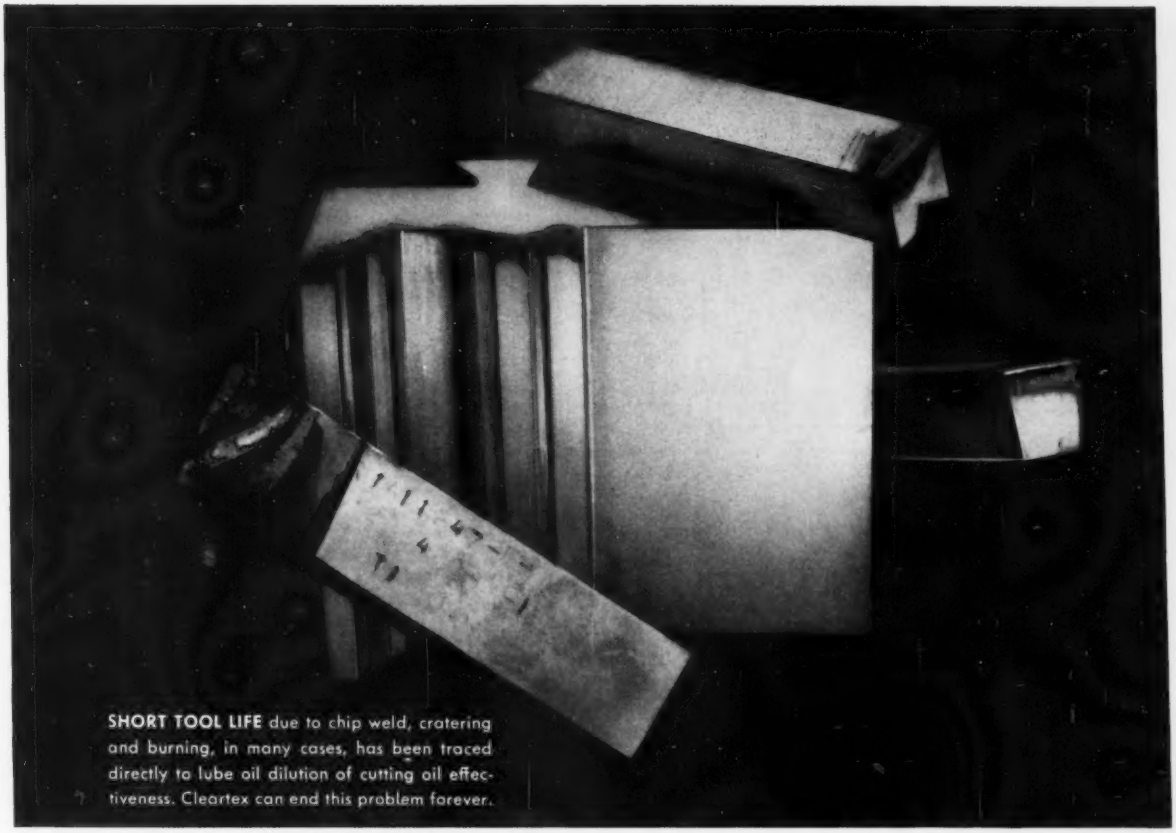
70 times more paper discs blanked out with TALIDE—over hard alloy die.

SHEET METAL DIES

137,000 hi-alloy steel pressure vessels drawn with TALIDE against only 7,900 with steel dies previously used.

POWDERED METALLURGY DIES

Compacting highly abrasive chemical powders, TALIDE pill dies last 4 months; steel dies wore out in 6 hours.



SHORT TOOL LIFE due to chip weld, cratering and burning, in many cases, has been traced directly to lube oil dilution of cutting oil effectiveness. Cleartex can end this problem forever.

Diluted cutting oil shortens tool life drastically

Lubricating oil is probably leaking into the cutting oil sumps of your automatic screw machines as you read this. Current research proves that this is happening in 70% of all the automatics in use today! And where it happens, it shortens tool life by as much as 50%—even 70%. On top of this, the cost of extra regrinds, lost production during tool changes, and excessive scrap production is putting a premium on screw machine operation in too many shops.

Look for these symptoms. One sure sign of dilution is the need for frequent refilling of the lube oil sump. If you are using an ordinary lube oil, this dilution will create two additional—and more costly—symptoms: excessive scrap production and frequent regrinds. Now you can eliminate these forever with the

TEXACO CLEARTEX CURE

The exceptional chemical stability and load-carrying ability of Texaco's Cleartex series make them equally suitable for use as cutting oils, lubricants or hydraulic fluids. All you have to do is use them for both cutting *and* lubrication. With Cleartex in *all* your sumps, you'll find cutting oil dilution will stop and screw machine production cost will drop substantially.

Write today for your copy of Texaco's helpful new booklet "Cleartex in Automatic Screw Machines"...and contact your local Texaco Lubrication Engineer for an authoritative survey of your automatics. Just call the nearest of the more than 2,000 Texaco Distributing Plants, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y. Dept. MA-21.

LUBRICATION IS A MAJOR FACTOR IN COST CONTROL

(PARTS, INVENTORY, PRODUCTION, DOWNTIME, MAINTENANCE)

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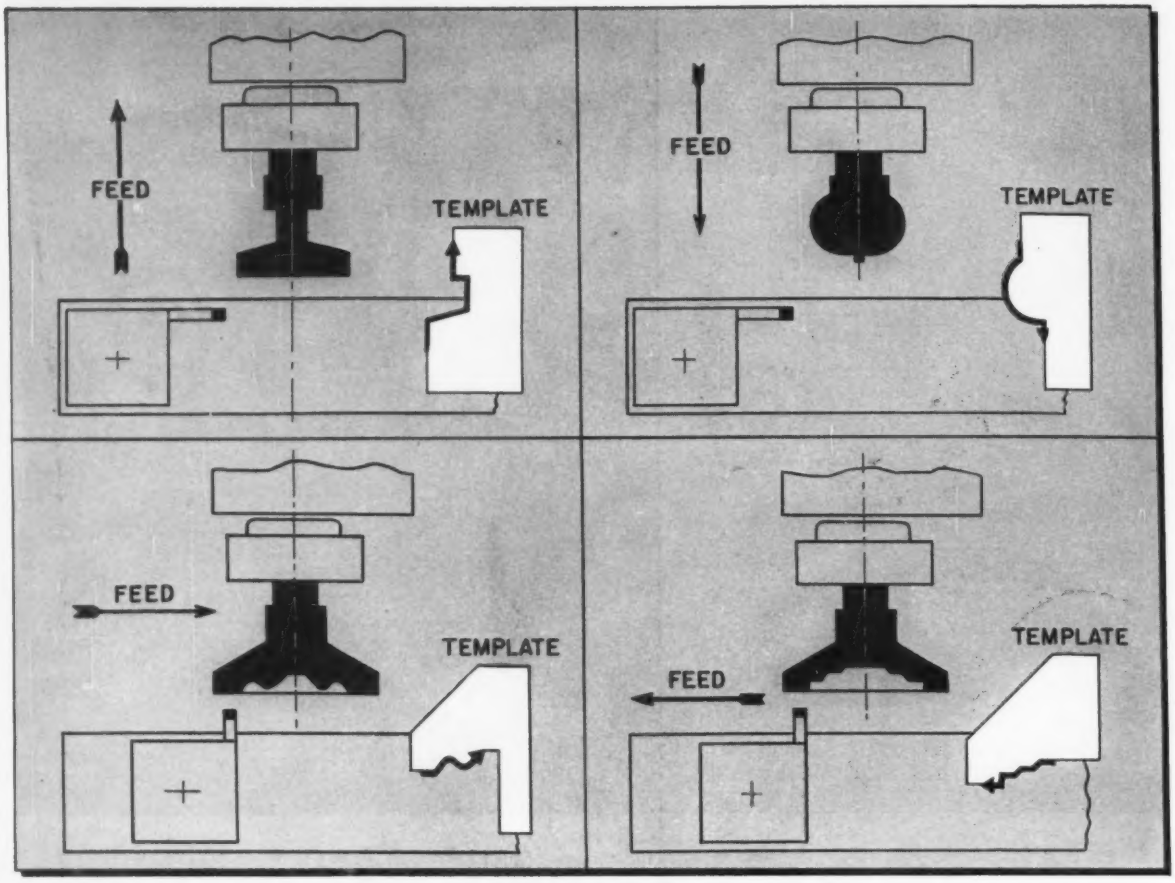


ALL FOUR of these Automatic Tracing Cycles are available with a SINGLE Jones & Lamson Turret Lathe

the man who needs a new machine tool is already paying for it

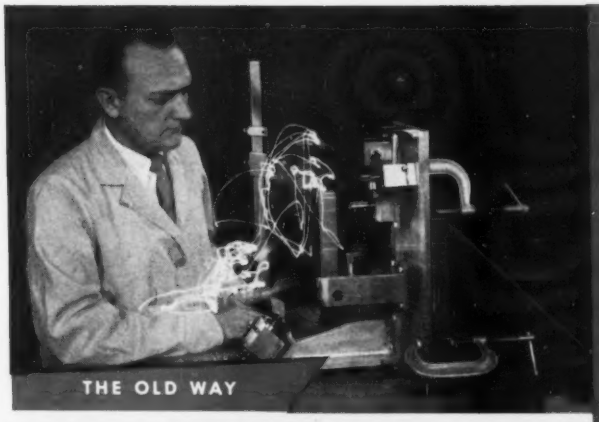
How's this for machine flexibility in one chucking? (1) You get all of the accuracy and tooling combinations offered by the standard J & L Turret Lathe. (2) You have more than 180° of tool travel control in each of four different automatic tracing cycles (you don't *have* to have *all* four, incidentally). (3) You do both rough and finish tracing (*with rough and finish tools*) in the same set-up. (4) You multiple-tool your tracing operations through 180° of tool control. (5) You have complete control for diameter with the conventional graduated hand wheel on either mechanical or *tracing* operations. (6) The original full swing of the Turret Lathe is retained with this tracer. (7) A single lever disconnects the tracer for standard turret lathe operation.

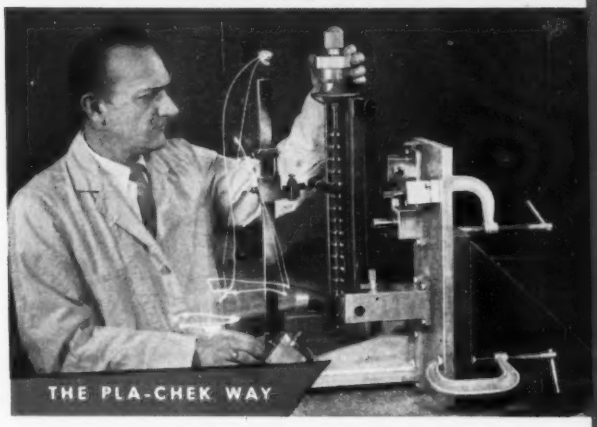
Such flexibility enables you to perform an amazing amount and variety of work with this new *Two-Dimensional Tracer* on J & L Saddle Type Turret Lathes.

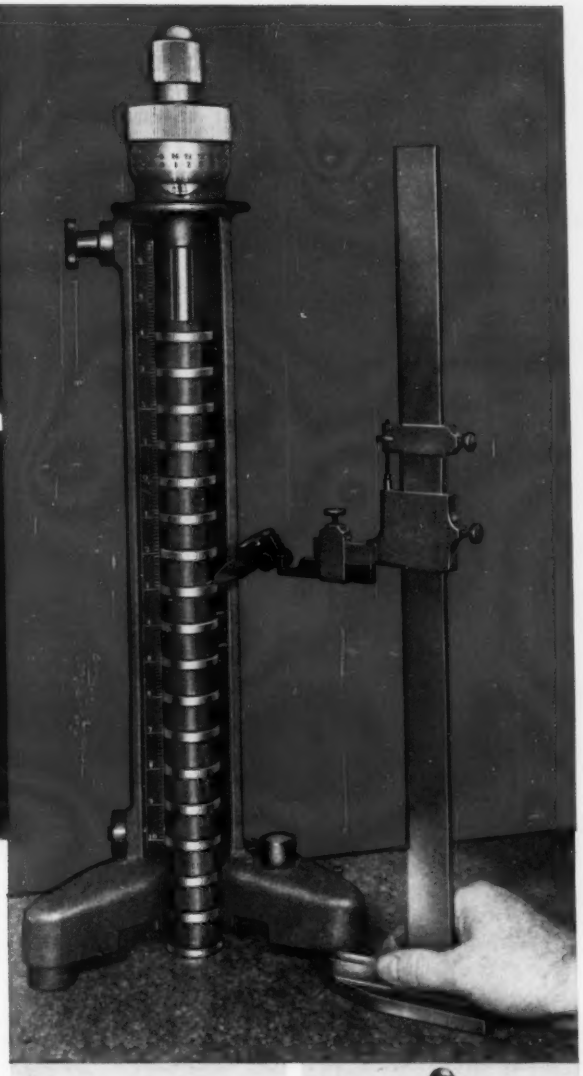
It all adds up to: MAXIMUM WORK COMPLETED IN ONE CHUCKING; REDUCED HANDLING TIME; INCREASED ACCURACY. Write for further information.

JONES & LAMSON Machine Company • Dept. 710, 512 Clinton St., Springfield, Vt.

Turret Lathes • Automatic Lathes • Tape Controlled Machines • Thread & Form Grinders • Optical Comparators • Thread Tools







See How PLA-CHEK Cuts Inspections from Minutes to Seconds

Notice the wrist light photos above. Just a turn of the Micrometer thimble and PLA-CHEK is set. Far fewer motions, far less time . . . and guaranteed accuracy to .00005″ throughout this PLA-CHEK'S entire range. No gage blocks or reference surfaces to touch—body heat can't affect it. Setting time 10 seconds . . . inspections in 1/5 the time of older methods. That speed and accuracy is being proved daily in thousands of installations throughout industry.

There are many other time-saving and money-saving features of PLA-CHEK Gages. Let us tell you about them. Write for complete, detailed literature.

COMPLETE RANGE OF SIZES

PLA-CHEK Gages are available in a full range of sizes to meet every inspection or surface plate layout requirement. Models are: The easily portable 6″ and 12″ sizes and the 18″ size (shown above) are guaranteed accurate to .00005″ throughout their entire range, and the 24″, the 36″ and the 48″ sizes are guaranteed accurate to .0001″ in any 24″ length or .0002″ over their entire range.

PRECISION RISERS

Built with the same precision as the gages themselves, PLA-CHEK Gage Risers may be used to extend the usefulness of every PLA-CHEK Gage from the smallest to the largest size. Available in 6″ height for 6″, 12″, 18″ PLA-CHEKS . . . 12″ height for 24″, 36″, 48″ models.

MICROMETER THIMBLE

Is graduated to .0001″ and provides dimensions between 1″ steps on measuring bar. Measuring bar of the 18″ model (as illustrated) and larger models, can be adjusted to enable the user to take readings up or down relative to a center line or other reference line on the work.

Cadillac GAGE COMPANY

P.O. BOX 3806 • DETROIT 5, MICHIGAN

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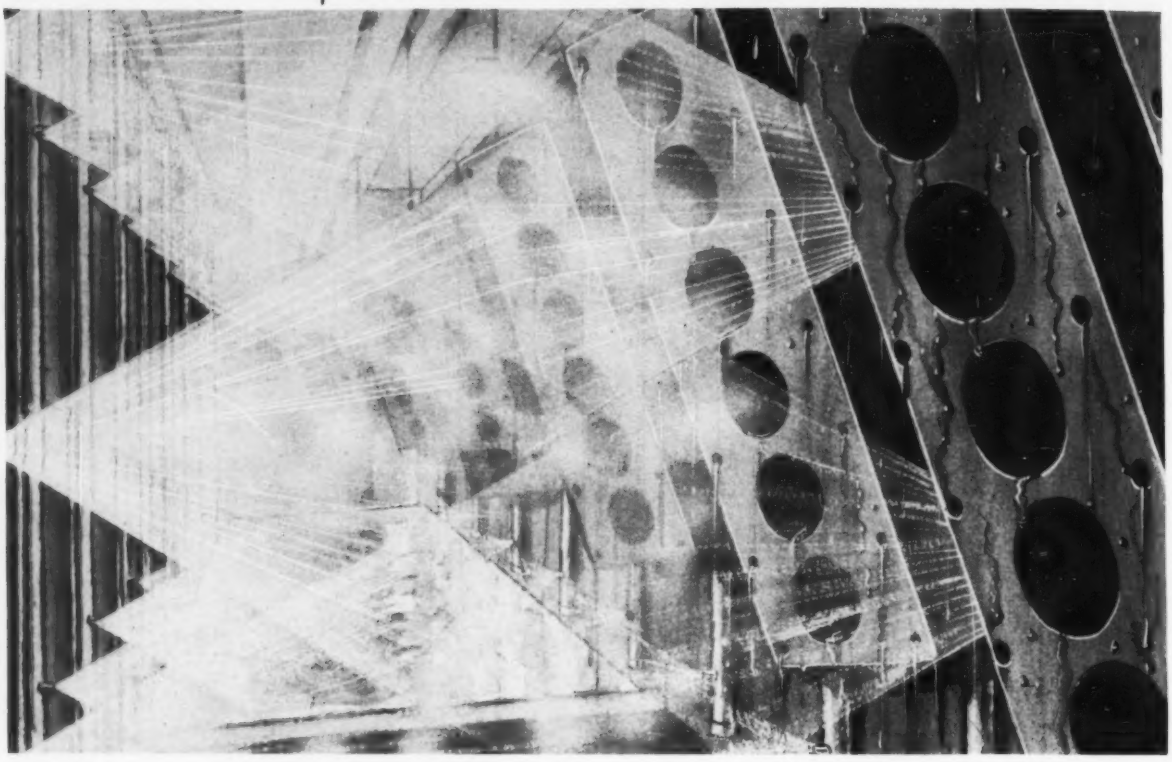
To get more from your spray washer

ask Oakite

OVER 50 YEARS CLEANING EXPERIENCE • OVER 250 FIELD SERVICE MEN • OVER 160 MATERIALS



New Oakite 198 sprays off soils fast . . . protects in-process parts from rust

Users tell us that nothing equals Oakite 198 for cleaning parts in-process. Here's why they think so:

- *It clears off heaviest soils at temperatures up to 180°F, and light soils at room temperature.*
- *Metal chips wash away under its action.*
- *When dry it leaves a protective film that prevents the rusting of machined or ground parts prior to assembly—yet it doesn't affect accurate gauging.*

Now largely used in automotive plants, Oakite 198 is proving its economy as well as its unique effectiveness in providing fast, smut-free cleaning plus rust protection. It works in single or multistage machines, at economical concentrations.

Oakite 198 is just one of a complete line of Oakite materials for machine cleaning. There are nonfoaming solvent agents for heaviest duty cleaning, alkaline cleaners for removing moderate to light soils. When you ask Oakite you can be sure of getting a cleaning compound designed to give you best possible results, designed to reduce your "per unit" cost. You can be sure, too, of getting prompt, intelligent in-plant service from your local Oakite man.

Send for Bulletin. Oakite Products, Inc., 26 Rector Street, New York 6, N. Y.

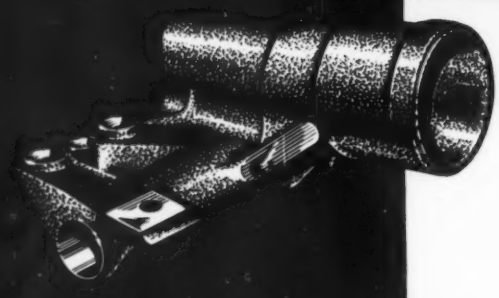
it PAYS to ask Oakite

OAKITE

50 1909-1959 SCIENCE

years' leadership in industrial cleaning

For more data, circle this page number on inquiry card

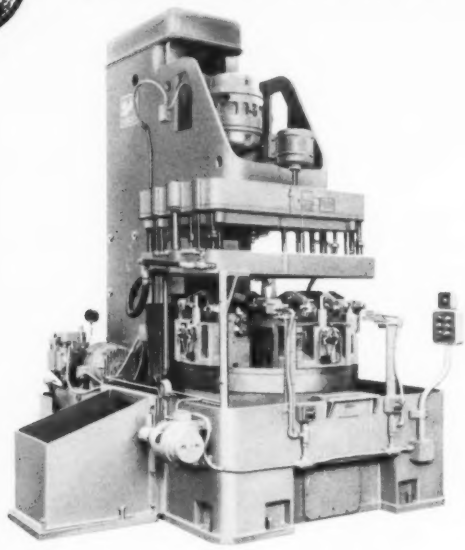


Buhr CONVERTIBILITY now adds years of useful life to machine tools

Convertibility, year by year, has become an increasingly vital feature of all Buhr Economatics. Today there is an even broader use than ever before of standardized 'building block' principles in Buhr machine components and fixtures while close tolerances on such parts insure maximum ease of convertibility.

Today you can count on an even greater part of the original investment in an Economatic to stretch out amortization periods.

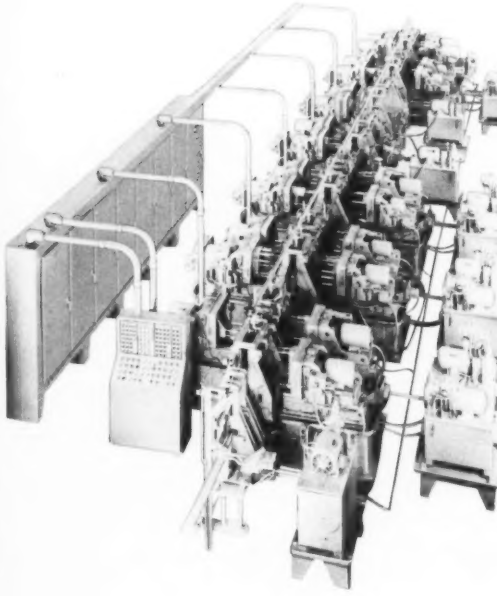
This part was redesign basic machine still pro



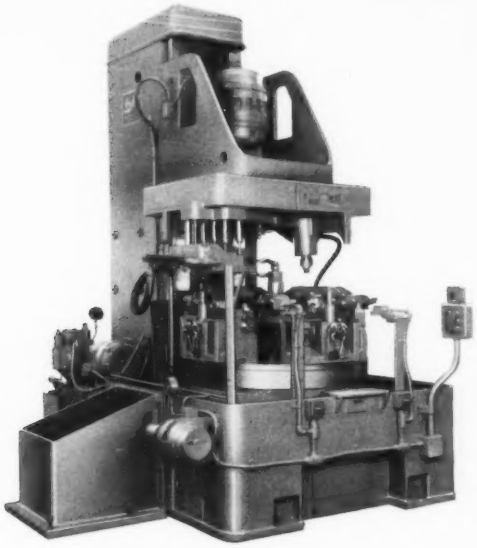
ORIGINAL: This 10-hp 6-station dial-index machine was the latest thing several years ago. It made power steering gear housings on a 33-second cycle.

Two recent ex can protec

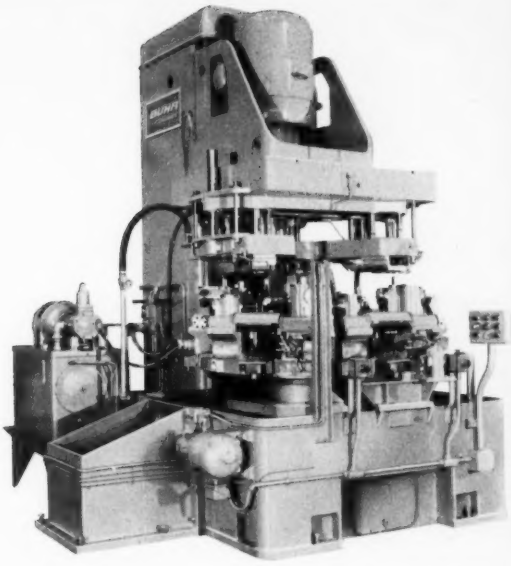
ORIGINAL: Three years ago, the then machine was producing torque converte on a 23-second cycle. Plate blanks we one end of the machine and, after auto adapters came out the other end.



...signed twice. The same ...produces it.



FIRST CONVERSION: Two years later, the machine was converted to a 4-station 15-hp dial, making somewhat different power steering gear housings on a 30-second cycle.



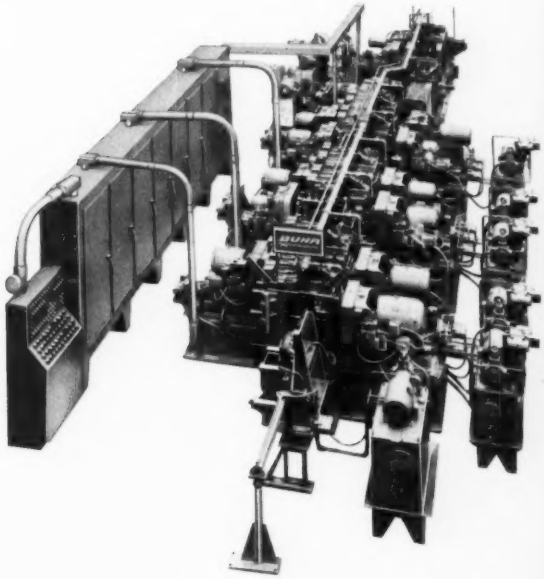
SECOND CONVERSION: Now, it is again a 6-station machine but with 40-hp main motor. Cycle time is still 30 seconds. The stepping up of power from 10 to 15 and then to 40 hp to keep pace with material changes illustrates the extra capacity built into Buhr machines. Conversion has simply kept it modern. Most of the original investment is still at work.

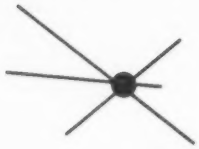
...examples show how *BUHR* convertibility ...tect your future machine investments

...then brand new Buhr transfer ...nverter housing adapter plates ...s were automatically fed into ...r automatic operations, finished

FIRST CONVERSION: When the "2-dimensional" adapters were discontinued, the machine was not retired. It was converted to making *three*-dimensional torque converter housings. Far from declining in efficiency, output of the Economatic was stepped up. Cycle time was cut to 14 seconds although the number of operations was increased to 94.

on the same basic Economatic





BUHR

MACHINE TOOL COMPANY
specializes in the design and construction of practical versatile multi-operation machine tools.

Basic features stressed in all Buhr machine tools include:

QUALITY—rugged design and manufacturing accuracy are combined to provide long trouble-free operation.

CONVERTIBILITY—Buhr uses standardized "building-block" parts wherever possible in its machines, fixtures, etc. All such parts are held to interchangeability tolerances.

PRODUCTIVITY—dependability is designed and built into Buhr machines to insure maximum productivity per man-hour consistent with production requirements.

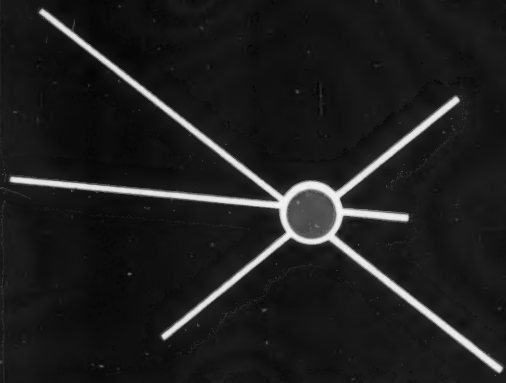
LOW DOWN TIME—every effort is made to minimize downtime by careful attention to future maintenance requirements, etc.

VERSATILITY—Buhr machines have a well-earned reputation in industry for their versatility. Many can produce a variety of parts with a minimum changeover time.

Buhr welcomes the opportunity of discussing your machining requirements. Give us a call or drop us a line.

BUHR
MACHINE TOOL COMPANY

ANN ARBOR, MICHIGAN



BUHR

the symbol of quality in multiple operation high and low production equipment

two examples

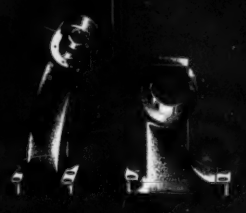
STEERING KNUCKLES

These tough steel steering knuckles must be machined carefully to prevent distortion. Two at a time come off a 16-station transfer after 26 operations.

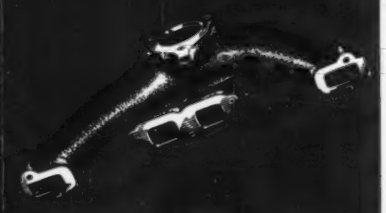
Transfer Machine #C-4572

7 different road machinery parts are produced on one automatic machine. Settings for different parts are pre-selected with a dial switch.

Shuttle-type Machine #C-4552



ROAD MACH'Y PARTS



MANIFOLDS

Cast manifolds (both LH and RH) are produced at a rate of one every 21 seconds on a 20-station machine.

Transfer Machine #C-4524

Connecting-rod caps are made from steel forgings in 12 operations on an 8-station dial-index machine. Four caps are finished in an 18-second cycle and they can be used without preselection.

Dial Index Machine #C-4965

CONNECTING-ROD CAPS

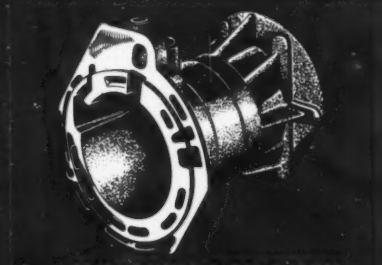
Typical jobs on various *BUHR* Economatics

Any random selection is naturally incomplete. If you don't see a part that looks like yours, send us a part print and we will be happy to tell you what Buhr Economatics are doing to cut costs on your type of part.

BUHR MACHINE TOOL COMPANY

ANN ARBOR, MICHIGAN

Ask for more information by machine number



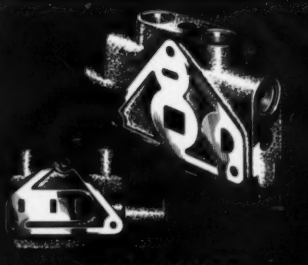
ALUMINUM OR CAST IRON

43 operations are performed on either aluminum or cast iron housings at 21 stations. Time cycle is 21 seconds per part.

Transfer Machine #C-4098

From 19 to 28 operations per part are performed on 32 different valve body styles on the same machine with only simple tool changes.

Trunnion Machine #C-5021



VALVE BODIES

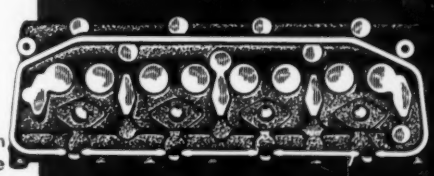
AXLE HOUSING

On this part, a short Buhr Economatic transfer machine has eliminated an annual retooling cost averaging $40,000 per year.

Short Transfer Machine #C-5188

All spark plug holes are combination drilled and reamed on a simple 2-fixture 4-station machine with a 12-spindle head.

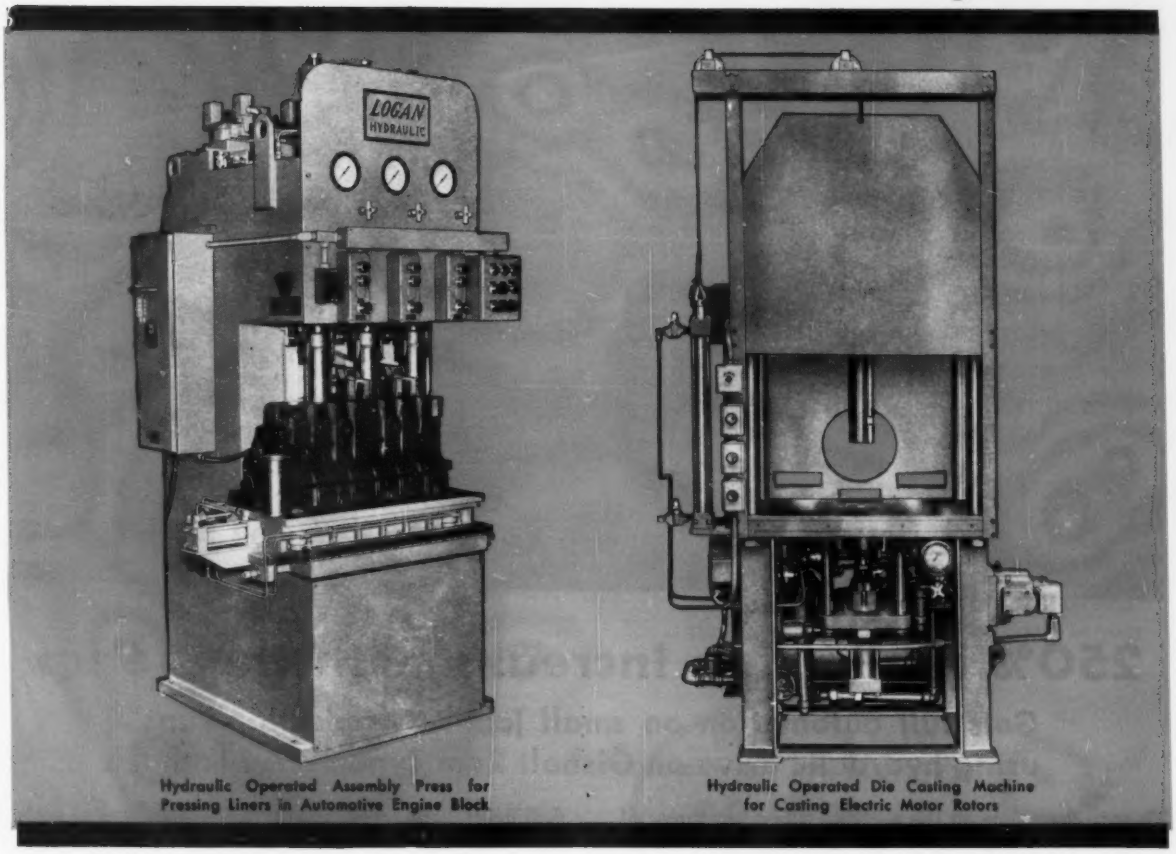
Single-station Machine #C-4941



CYLINDER HEADS

BE SURE!

Look to Logan



Hydraulic Operated Assembly Press for Pressing Liners in Automotive Engine Block

Hydraulic Operated Die Casting Machine for Casting Electric Motor Rotors

when you require special air or hydraulic-operated equipment for PRESSING • STAKING • FORCING CASTING • FORMING • SIZING

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for further details ask for bulletin 7-A

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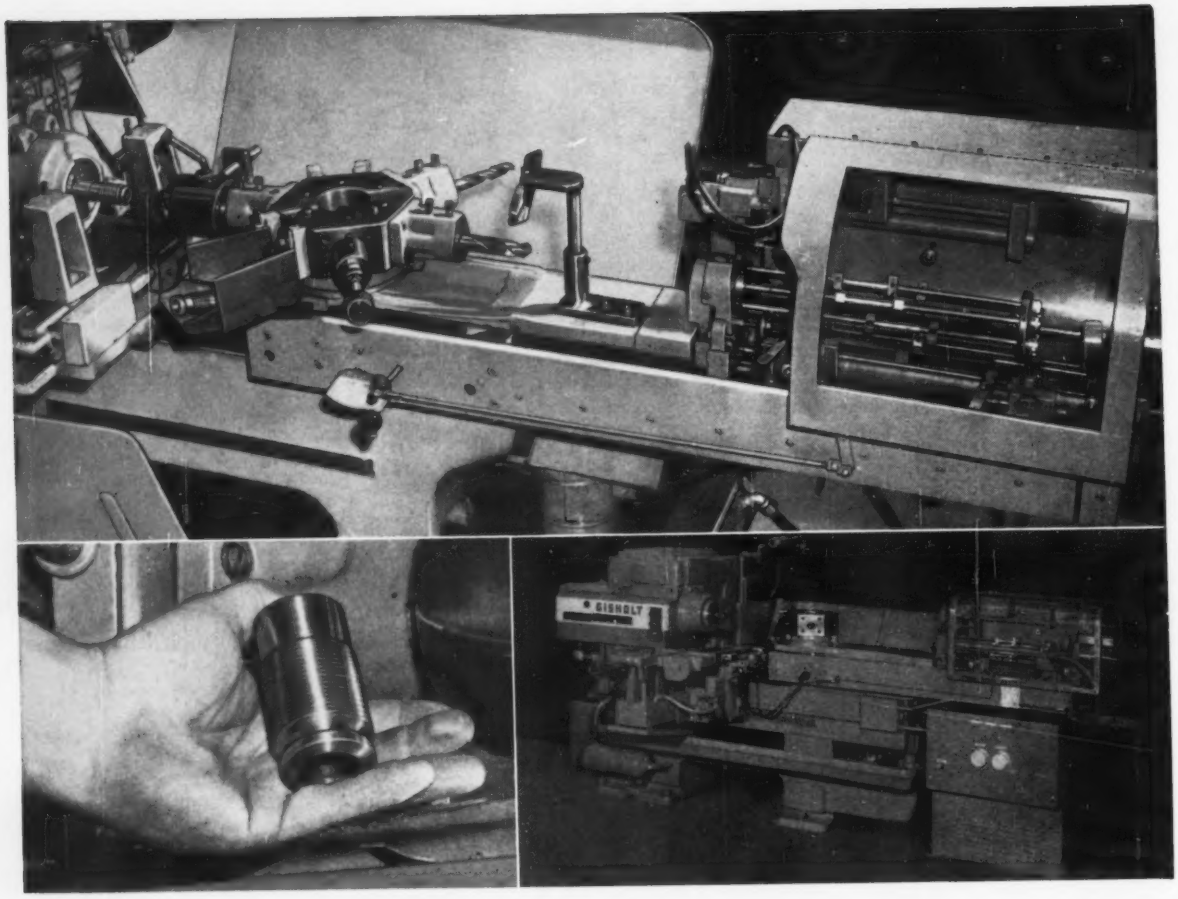

250% Production Increase with this setup

Gets full automation on small job-lot production runs using hydraulic drive on Gisholt Ram Type Turret Lathe

Floor-to-floor time on the job shown here—a threaded collar 3⅛" long with 1 11/16" diam.—was cut from 8.1 minutes (with hand operation) to just 3.25 minutes. All operations and machine functions are automatically controlled with the Lynn Hydraulic Drive Unit on a Gisholt Ram Type Turret Lathe.

Here's how the finished workpiece is completely machined from bar stock in one fast, automatic operation: The stock is fed pneumatically against a turret stop, chucked, start-drilled, then finish-bored with a large drill. The hydraulic drive backs the drill out automatically to clear the chips, then rapid traverses back to where it left off before dropping into feed to resume drilling. Spindle speed automatically decreases as tools on the front cross slide form the O.D., drops into lower speed as O.D. is threaded, and into another low speed as radii are formed on the finished part and on the end of the bar stock. A tool on the rear cross slide cuts off the finished part and the job is done in record time.

With its massive design, reserve power and extra spindle speeds, the new Gisholt MASTERLINE Ram Type Turret Lathe is particularly adaptable to complete automatic operation with Lynn Hydraulic Drive. Contact your Gisholt Representative. He has the complete facts—and his wide experience may point the way to more profitable operation for you.

MASTERLINE GISHOLT SINCE 1887 GISHOLT

GISHOLT MACHINE COMPANY
Madison 10, Wisconsin, U.S.A.

WRITE GISHOLT TODAY for all-new, 18-page illustrated Bulletin 1174-B covering features, accessories, tools and floor plans on new Gisholt MASTERLINE Ram Type Turret Lathes.

ASK YOUR GISHOLT REPRESENTATIVE ABOUT GISHOLT FACTORY REBUILT MACHINES WITH NEW MACHINE GUARANTEE

Test The DIMENSIONAIR Against Any Other Air Gage!

Set this gage quicker than you can set your watch. Once set, it stays set! *It can't drift.*

No need to keep a stockpile of dials. This 7½" *accurately calibrated, all-useable* scale will answer every normal gaging need. Operator cannot change magnification or monkey with your gaging tolerances.

Longer approach range. Greater plug clearance. Easier exploration. Longest useful life. Self-cleaning jets. No centralizing error.

NOTE:
Accurate setting is guaranteed with one master.

You will find the DIMENSIONAIR measures . . .

- **More Accurately**
- **More Dependably**
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This is not just a claim . . . it's a statement we're ready to back up. We offer you the chance to try the Dimensionair on a "no strings-attached" trial basis in your own shop. But, if possible, try it in direct competition with any other leading air gage so there will be no doubt in your mind about the best gage to use.

MAIL THIS EASY-TO-CLIP COUPON TODAY!

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O. K. Prove it! Let us try a DIMENSIONAIR.

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Dial Indicating, Air, Electric, or Electronic—for Inspecting, Measuring, Sorting, or Automation Gaging

NEW

"Buffalo" No. 3A R-P-Mster with 2" Capacity and Torque-controlled Feed!

Welcome news for metalworking men! The new "Buffalo" No. 3A R-P-Mster brings you a rated capacity of 2" in mild steel.

Equally important is the exclusive "Buffalo" Torque-controlled Power Feed. With it you can safely use maximum speed and feed for the size hole being drilled. No need to worry about damage to drill or machine gearing. Danger of overloading the machine is positively eliminated by the torque control on the feed shaft.

Moderate price makes the new "Buffalo" No. 3A R-P-Mster your best variable speed drilling machine buy. All the other famous R-P-Mster features are retained — "1001" speeds, easily and quickly changed — extreme accuracy, smoothness, quietness and ease of drilling — rugged construction for long life with a minimum of maintenance. Available in 1 to 6 spindle models.

Only when you operate it yourself will you really appreciate these advantages of the "Buffalo" No. 3A R-P-Mster. Discover today how it can cut your drilling costs, increase production. Phone your "Buffalo" machine tool dealer for a demonstration, or write direct for Bulletin 3257-C.

Above: Multiple Spindle Pedestal Model
Left: Pedestal Model

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440 BROADWAY BUFFALO, N. Y.
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

"Buffalo"

DRILLING • PUNCHING • SHEARING • BENDING

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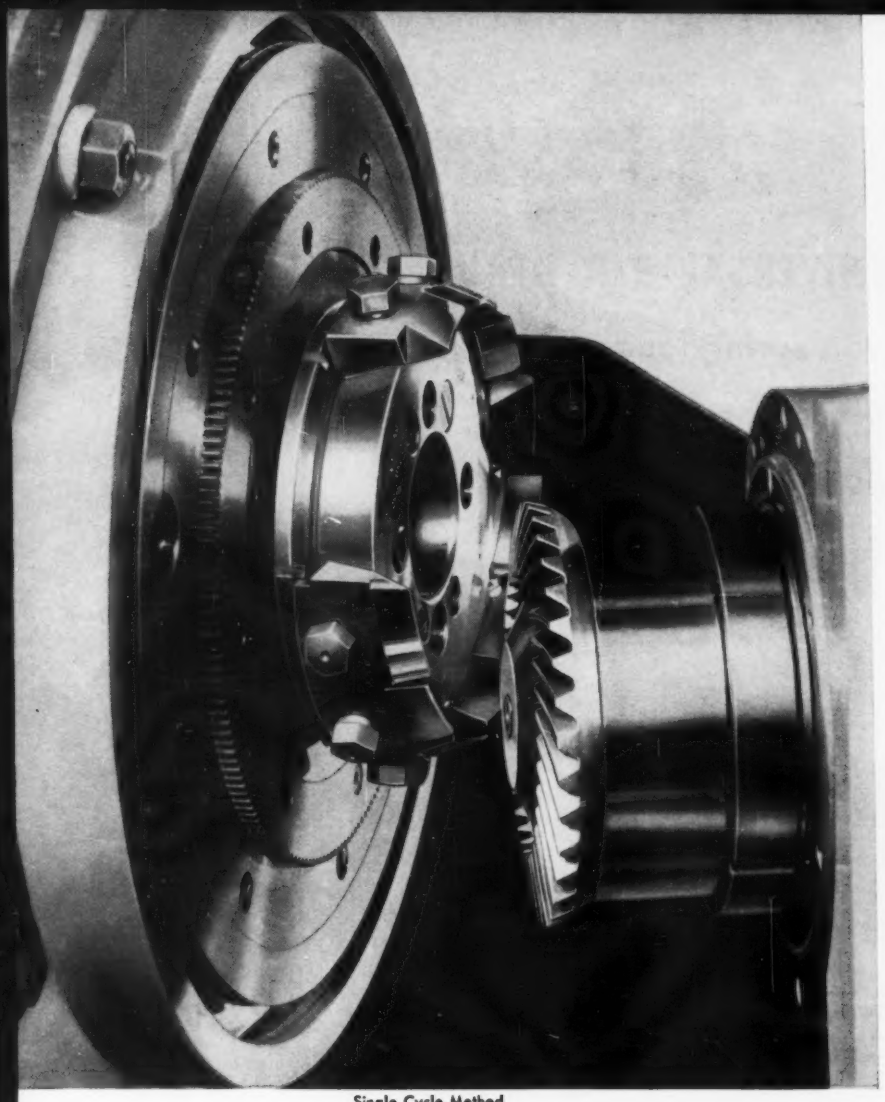
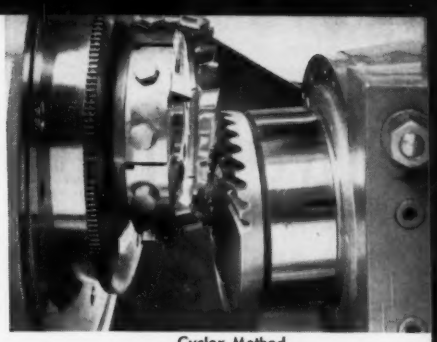
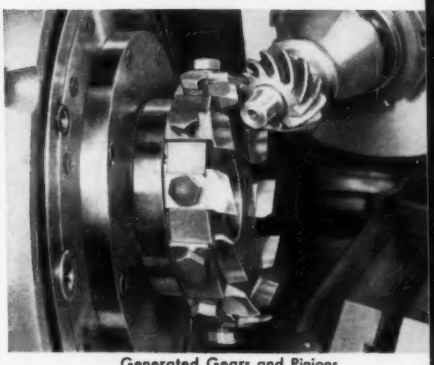


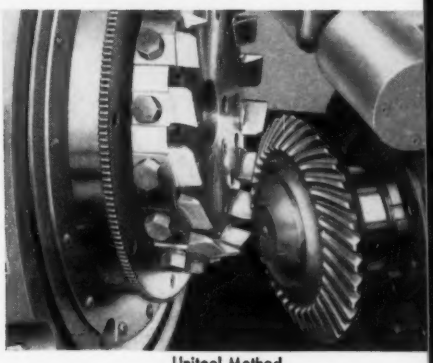
Single Cycle Method



Cyclex Method



Generated Gears and Pinions



Unitool Method

Cut gears with *four* different methods on *one* machine

If you expect your gear needs to change over the years you'll appreciate the exceptional versatility of the Gleason No. 108 Hypoid Generator. With this one machine you can cut both gears and pinions by four different methods:

Single Cycle® Method. Using this method you can cut nongenerated gears four to five times faster than previously possible on machines of this type. Cradle and work head are locked in position. The last rotation of the Single Cycle Cutter finishes both sides of a tooth space. You cut the mating pinions on the same machine using the conventional single-roll Generating Method.

Cyclex® Method. For certain applications you can use the extremely fast Cyclex Method on the No. 108 Generator. You cut nongenerated gears in one completing operation from the solid blank.

Generated Gears and Pinions. You can produce both gears and pinions on this machine with the Generating Method. Here, a relative rolling motion takes place between gear or pinion and the rotating cutter.

Unitool* Method. If you want to cut small quantities of spiral bevel, Zerol® bevel, or hypoid gears with a minimum of tooling, you can use the Unitool Method. You cut both gears and pinions with a single cutter. This method is particularly useful for experimental gears for prototype work.

The No. 108 Generator cuts gears up to 8½″ diameter at a 10:1 ratio and to a maximum of 4 DP. You can get the same versatility in cutting larger gears with the No. 118 Hypoid Generator which handles gears up to 18″ diameter, 10:1 ratio, to a maximum of 2 DP. A third model, the No. 28 Hypoid Generator, cuts gears up to 33″ diameter at 10:1 ratio, 1½ DP.

Send for free bulletins on all three machines.

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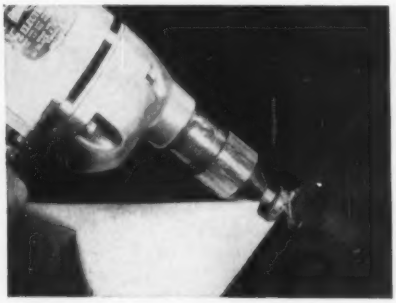
INGENIOUS NEW... UNIVERSAL R&R DEBURRING TOOL

with spring loaded retractable blade eliminates chatter gives precision-cut edge or chamfer at high speed

The cutting action of Model 955 Universal R&R chatterless Deburring Tool (on the left) is effected by spring tension against the blade. On Model 956, right, the spring tension is against the body. This is adjustable to regulate the depth of cut. The blade is free-floating to allow self-alignment and uniform stock removal.

The new Universal R&R Tool makes a handy horizontal deburrer when used with a portable drill held in a vise. With proper adjustment, the R&R Deburring Tool is CHATTERLESS. A new design allows the bearing angle of the tool body and the blade to be in continuous contact with the work piece at all times.

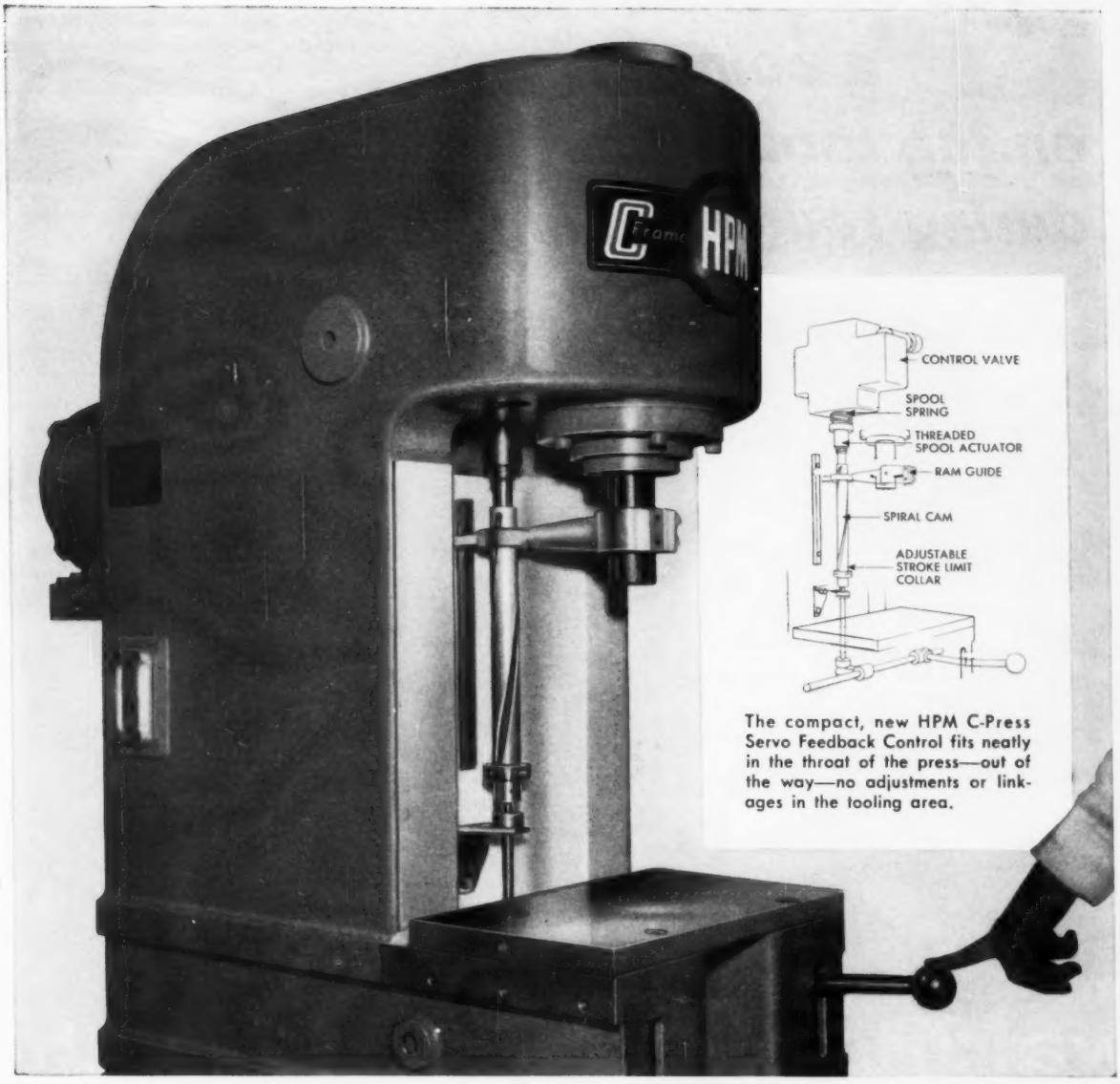


R&R Deburring Tool used in electric drill as a portable unit for heavy plate or other objects too heavy to handle. Blades of the R&R Deburring Tool are replaceable at nominal cost from stock. They are made of high speed steel, precision hardened and ground to close tolerances for interchangeability.

Used in any standard drill press at the high operating speeds recommended by the makers of high speed steels, the R&R Deburring Tool performs most efficiently. High operating speeds mean more production, lower costs. Each tool is made in a full range of sizes to 1½" diameter.

UNIVERSAL ENGINEERING COMPANY | FRANKENMUTH 2, MICHIGAN

X9



The compact, new HPM C-Press Servo Feedback Control fits neatly in the throat of the press—out of the way—no adjustments or linkages in the tooling area.

SERVO-FEEDBACK . . . NEW DEMAND-RESPONSE CONTROL FOR MANUAL C-PRESS OPERATIONS

INSTANT RESPONSE to the demand of the hand lever is featured in new Servo Controlled H-P-M C-Presses. The new system offers many advantages. Ram speed is directly proportionate to rate of lever control movement through a direct metering valve. The application of *force on work* is in direct response to movement of the control lever. The *position* of the ram is accurately controlled by the lever until the work is contacted. The pressure control then takes over and further lever movement increases pressure on the work. Releasing the lever will immediately decrease the pressure and then return the press ram to its adjustable up position. The downward travel of the press ram may be limited by means of the adjustable lower stop-collar.

This direct relationship between demand and response is accomplished by a unique, compact, spiral cam principle that meters oil to the cylinder in direct response to the action of the hand lever. For *straightening* operations it permits the operator to apply force on work to gauge readings — accurately and effectively. For *compacting* it permits rapid approach, slow pressing or bumping, repeat strokes if needed. *For lab or experimental work* where applied force must be carefully analyzed, the HPM C-Press offers many advantages.

Many production jobs may be improved through the use of this unique and versatile manual press line. Available in 5, 10 and 15 ton models. Get the complete details by asking for Bulletin H58CPM. Plan for more profits by planning with H-P-Ms.

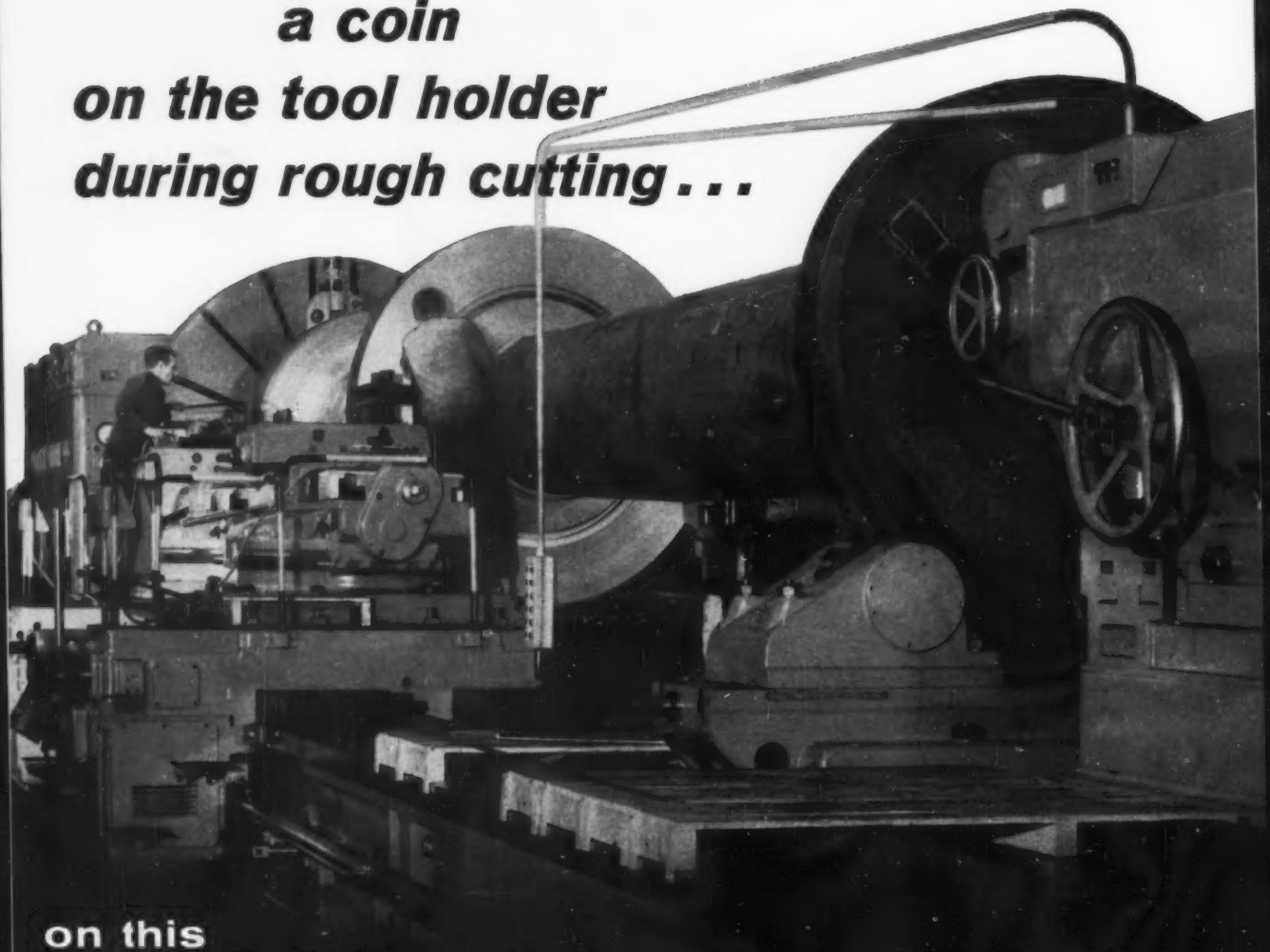
HPM

THE HYDRAULIC PRESS MFG. COMPANY

A Division of Koehring Company, Mount Gilead, Ohio, U.S.A. H901

For more data, circle this page number on inquiry card

you can balance a coin on the tool holder during rough cutting . . .



on this

waldrich high speed lathe

Series WSD

- Rigid construction insures vibration-free operation with carbide tools.
- Maximum utilization of horsepower in main drive
- Rugged headstock
- Heavy duty tail stock
- 3-way and 4-way bed design
- Fast, efficient chip collecting

Write for details today.

WALDRICH SIEGEN

american waldrich mfg. corp.

1232 PENN AVENUE, PITTSBURGH 22, PENNSYLVANIA

Hydraulic pre-selection of speeds set by handwheel and read on illuminated dial. 16 spindle speeds—ratio 1:50—up to 310 rpm for carbide machining on Model KE 100. Table runs on tapered roller bearings.

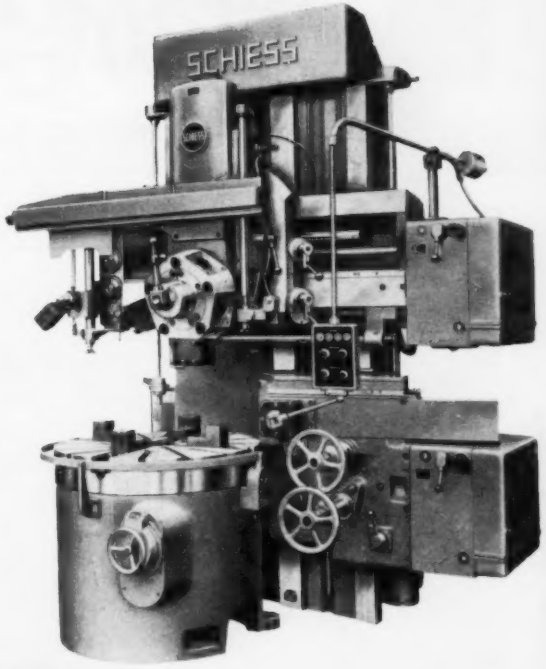
Fingertip control for direction of feed and rapid traverse with spring-loaded mono-levers for normal direction plus angular compound feeds. Mono-levers move in same direction as desired feed or traverse movement, simplify correct setting by operator. Specially designed electro-magnetic disc clutches disengage feed instantly with no over-riding or coasting.

Counterbalanced cross rail and side head. Single lever unlocks, raises or lowers, and locks cross rail simultaneously by electro-mechanical controls. *No bolts or nuts to loosen or tighten by hand.*

Slip ring motor provides smooth "load sensitive" acceleration and braking. Variable speed as well as constant cutting speed available. Motor mounted on left side of machine with separate control enclosure. Fingertip control assured by pendant mounting of all necessary control functions. Electrics supplied from all U. S. manufacturers.

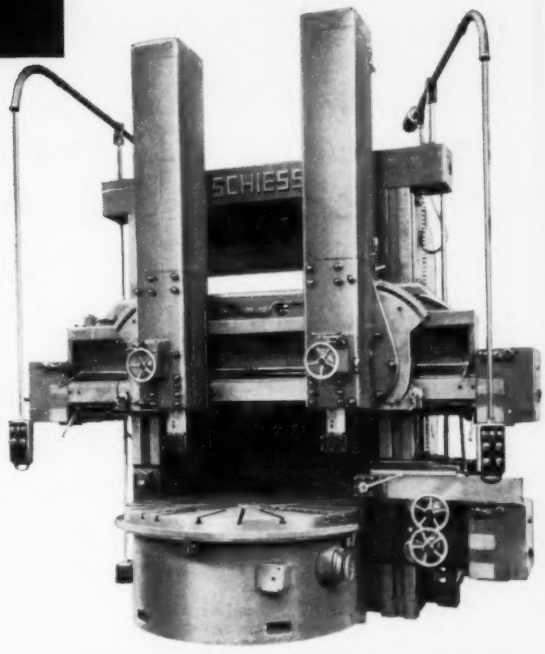
Copying attachment with electric tracer for use on cross rail or side head.

Model KE Single Column Vertical Turret Lathes with 40", 50" and 65" turning diameters for high-speed carbide machining.



See why tool engineers call these heavy producers, "MOST MODERN MACHINES OF THEIR TYPE"

Model KZ Double Column Vertical Boring Mills with 65", 80", 98" and 118" turning diameters.



All operating features of KE Series Vertical Turret Lathes are combined in

SCHIESS KZ DOUBLE COLUMN VERTICAL BORING MILLS, PLUS—

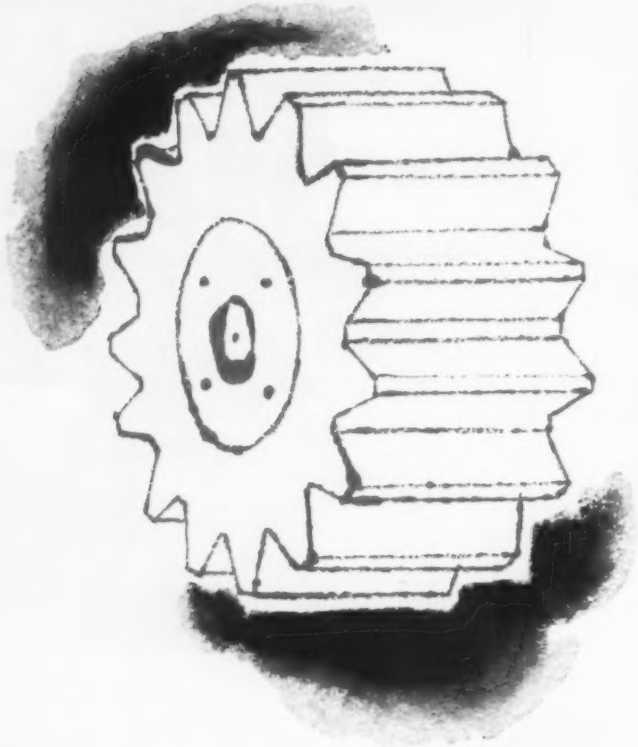
Heads equipped with steel octagon rams can be swiveled—have automatic feed in vertical, horizontal and angular direction and are independent of one another as to amounts and direction of feed. Table, feed and rapid traverse controls are all contained in the pendant station. Standard model KZ Double Column Vertical Boring Mills are available with 65", 80", 98" and 118" turning diameters.

Get to know these products of Europe's largest builder of heavy machine tools. Parts and service are as close as Pittsburgh. An American Schiess engineer will be ready to help you size up these heavy producers for your heavy production needs. Write for catalogs and complete specifications on these and other Schiess equipment.

SCHIESS

AMERICAN SCHIESS CORPORATION

1232 Penn Avenue, Pittsburgh 22, Pa.



Gears... Cutting Oils... and How to Save Money

The more gears your equipment can hob before tool change, the lower your cost of operation. Sinclair Ordnance Cutting Oils have earned the reputation for increasing tool life because of their high heat dissipation characteristic. Furthermore, a special E. P. agent assures the highest quality finish . . . more money saved through fewer rejects. Switch to Ordnance, now. Next time management asks how you've cut costs, tell them you've changed to Sinclair—and show them the results.

Call your Sinclair Representative for further information or write for free literature to Sinclair Refining Company, Technical Service Division, 600 Fifth Avenue, New York 20, N. Y. There is no obligation.

Sinclair
Ordnance Cutting Oils

Tool Steel Topics

BETH EHEM STEEL

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

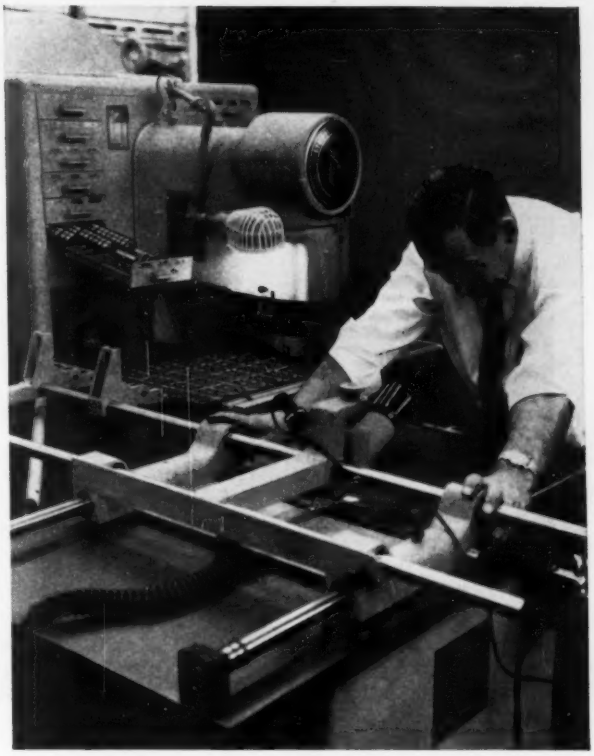
It's so easy to punch hole patterns fast with BTR

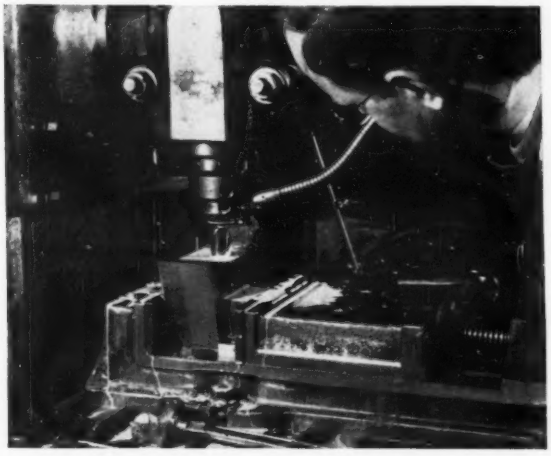
A punch made from BTR tool steel is the key element in this punching mechanism. It speeds the accurate reproduction of hole patterns, by remote control from a template, in sheets of steel, brass, aluminum, or plastic.

The BTR punch has proved both reliable and economical. This is the report from Wales-Strippit Inc., Akron, N. Y., a unit of Houdaille Industries, producers of the equipment. The Bethlehem tool steel is supplied by Leed Steel Co., Buffalo, one of our local tool steel distributors.

BTR is Bethlehem's general-purpose manganese-chromium-tungsten grade of oil-hardening tool steel. It's safe hardening, easy to machine. Combining abrasion-resistance and toughness, it's ideal for a wide range of tool and die uses.

Put BTR to work in your shop. A trial order can be delivered quickly by your Bethlehem tool steel distributor who carries BTR in stock in a wide size range.





New Free-Machining Tool Steel

Bethlehem Air-4 is an air-hardening tool steel which can save you time and money in scores of applications. It is a free-machining grade, and hardens at about 1550F. It combines excellent wear-resistance with a high degree of toughness. Ask your distributor for full data on Bethlehem Air-4.

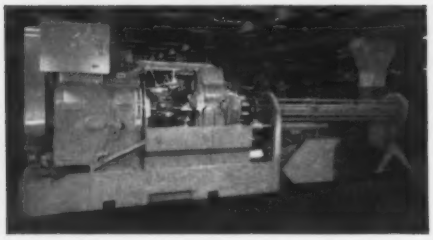
BETHLEHEM TOOL STEEL ENGINEER SAYS:

Decarburized surfaces are the cause of premature tool failures

The great majority of toolmakers know that decarburized metal must be removed completely from the working surfaces of tools. It is not so widely known that it is often best to remove this skin from other portions of the tool.

This precaution is especially necessary on tools which are subject to repeated impacts. For example, a pneumatic chisel which has a forged shank often breaks because of a fatigue failure. As a rule there is a stress concentration in the shank, due to the change in section. When this tool surface is also decarburized, rapid failure in service can occur.

The outer layers of a decarburized tool haven't the strength of the effectively hardened tool steel base. Therefore only one procedure can be considered safe. It is to grind off the "decarb" on *all* tool surfaces.



Acme-Gridley, 1¼" RB 8 producing 690 nozzle bodies per hour

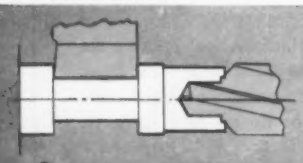
Close-up of tooling zone showing 5th, 6th and 7th positions.

ACME-GRIDLEY ELIMINATES SECONDARY OPERATIONS...

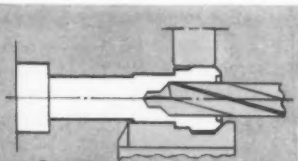
for Eagle Manufacturing Company

- Direct Cost Reduced 48%*
- Production Time Reduced 64%

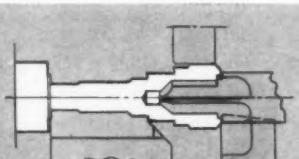
* Details on request



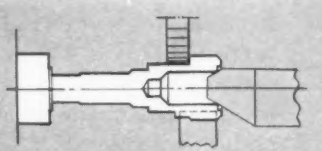
8. Feed out—rough form rear diameter—counterbore and drill large hole part way



1. Form two front diameters and chamfer head—drill large hole remainder—support



2. Form two rear diameters—ream large hole—face end—support



3. Stop spindle rotation—mill flat—support

As a part of a continuing contribution to all phases of cost reduction, National Acme engineers initiated the development work necessary to effect important savings for this 65 year old Wellsburg, W. Virginia company.

The aluminum nozzle body of their hydraulic pump oilers formerly had been produced on a six spindle automatic and two other machines performing secondary operations. Visionary machine tool engineering made possible the application of spindle stopping and positioning on an eight-spindle Acme-Gridley to complete the entire piece *in the primary set-up . . . and increase net production.*

Advanced design and development such as this, together with wide open tooling zones, independently operated tool slides and the extreme accuracy and flexibility of direct camming . . . makes possible the solution of "unusual" jobs an "every day" occurrence at National Acme.

Write or ask one of our representatives for the complete story on the industry's most modern approach to *your* cost reduction problem.

NATIONAL ACME'S
"ZONE OF RESPONSIBILITY"
INCLUDES ALL PHASES OF COST REDUCTION

Check YOURS...Then Check National Acme

Direct Costs: these include direct dollar savings as realized by the Eagle Manufacturing Company . . . an "every day" job for Acme-Gridleys.

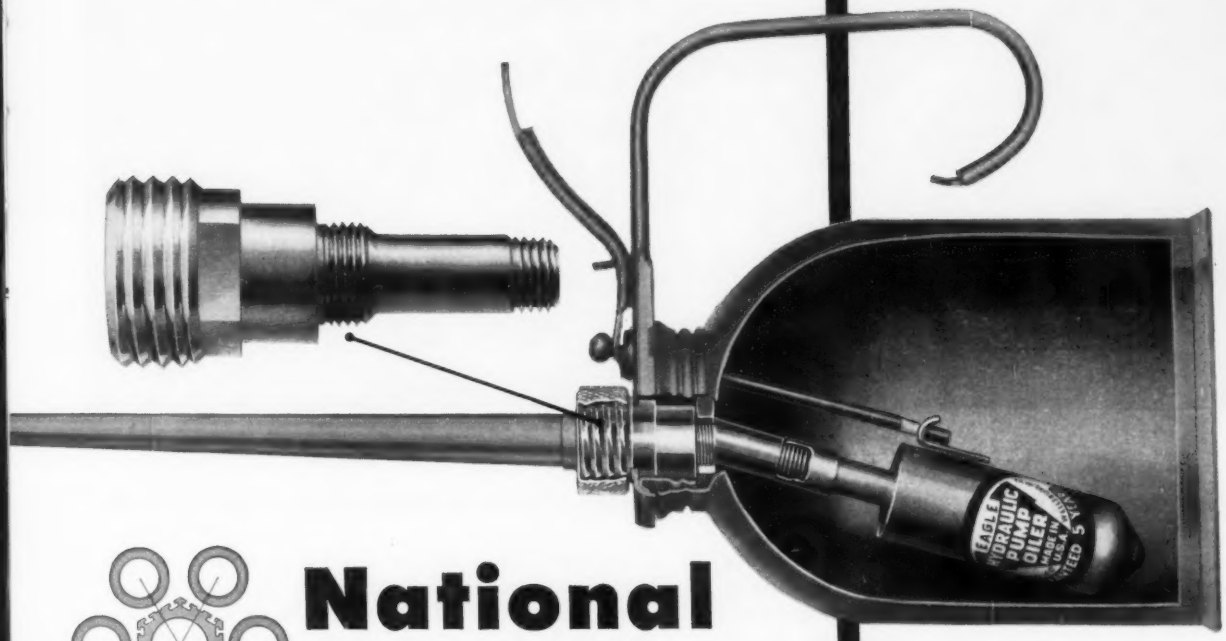
Indirect Costs: effecting important savings in maintenance, downtime, scrap reduction, tool costs, etc.

Product Redesign: teaming with *your* design group to take full advantage of Acme-Gridleys' cost reducing capabilities.

Direct Material Costs: our engineers provide important savings in this area by constantly matching machines and tools to modern metallurgical problems.

Make-or-Buy Reviews: in many cases our Contract Division can assume your production headaches and relieve you of immediate capital investment.

Spot Modernization: pioneering in modern tooling methods, and the flexibility of Acme-Gridleys can provide many "on-the-spot" savings.



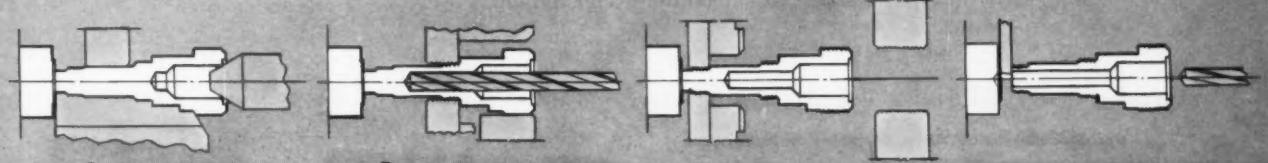
National Acme

The National Acme Company
179 E. 131st Street
Cleveland 8, Ohio

Sales Offices: Newark 2, N.J.; Chicago 6, Ill.; Detroit 27, Mich.

Pioneer in Circumferential Automation

15 Operations in 5.5 Seconds



4. Start spindle—shave all over—support

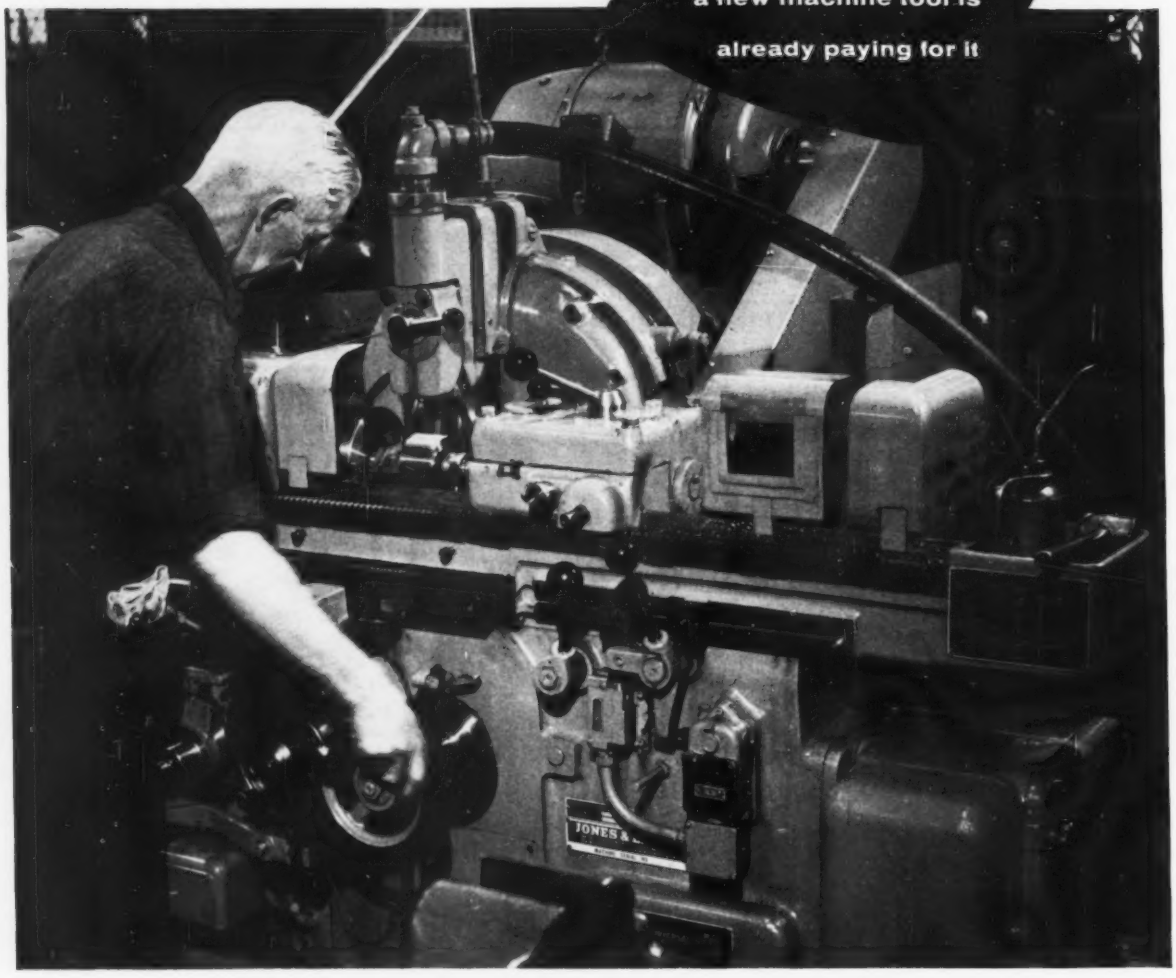
5. Roll center thread—drill small hole part way—support

6. Roll rear thread—thread head

7. Drill small hole remainder—cutoff

JONES & LAMSON MACHINE TOOLS

the man who needs a new machine tool is already paying for it



Close Tolerance Tool Room Work on an Automatic machine with Universal Application

A customer writes: "The versatility of Jones & Lamson Thread Grinders is scarcely tested in the conventional production of hobs, taps, gages and threaded parts. In our toolroom, using the thread grinder as a basis for 'Rube Goldberg' development, we have produced precision racks, small form-profiled milling cutters, oil grooves and grinding wheel crushers.

"While serving the purpose as a necessary piece of equipment, this machine also provides a means by which many additional production problems can be explored and tested. Applying the thread grinder to toolroom problems is putting the best foot forward for quickly producing accurate and dependable shop accessories."

* * *

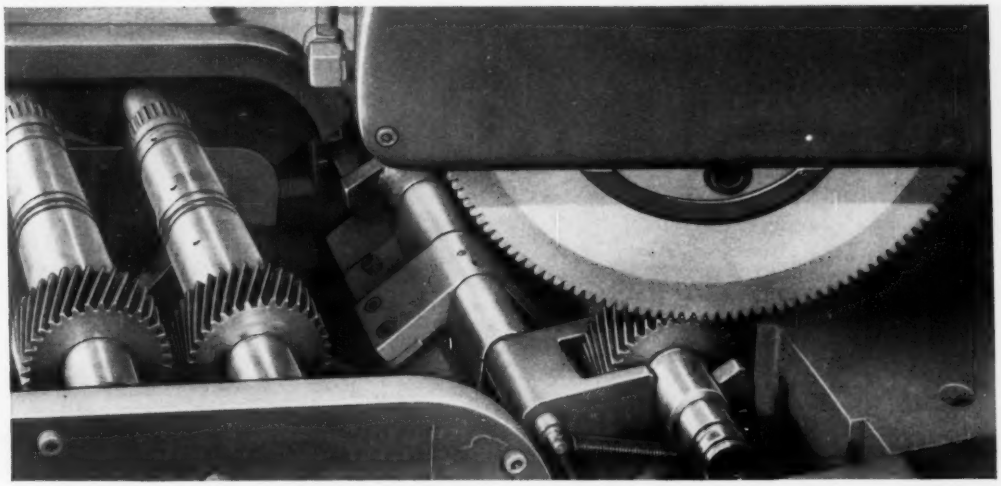
Write for catalog 600. Jones & Lamson Machine Company, 512 Clinton Street, Springfield, Vermont.

Turret Lathes • Fay Automatic Lathes • Milling & Centering Machines • Thread & Form Grinders • Optical Comparators • Thread Tools

For more data, circle this page number on inquiry card

Hard Gear Tooth Honing has completed the transition from an engineering research project to its present operational status in less time than any other major development in the field of modern gear practice. Why? Because Hard Gear Honing satisfies a long recognized need more economically than any other known process.

RED RING HARD GEAR HONING Has Won Wide Acceptance



USERS

- The aircraft industry
- The automotive industry
- Computing machine manufacturers
- Motorcycle industry
- Tractor industry
- Gear manufacturers
- Electric motor (gear head) industry
- Machine tool builders

GEARS BEING HONED

- Transmission gears
- Timing gears
- Change gears
- Computor gears
- Main drive gears
- Motorcycle gears

PURPOSE OF HONING

- To remove nicks and burrs
- To improve surface finish
- To improve noisy gears
- To salvage rejects
- To quickly detect errors in prior machining
- To correct minor heat treat distortions

For complete details on Hard Gear Honing, write for Bulletin H-57-2.

SPUR AND HELICAL GEAR SPECIALISTS
ORIGINATORS OF ROTARY SHAVING, GEAR HONING AND ELLIPTOID

8269

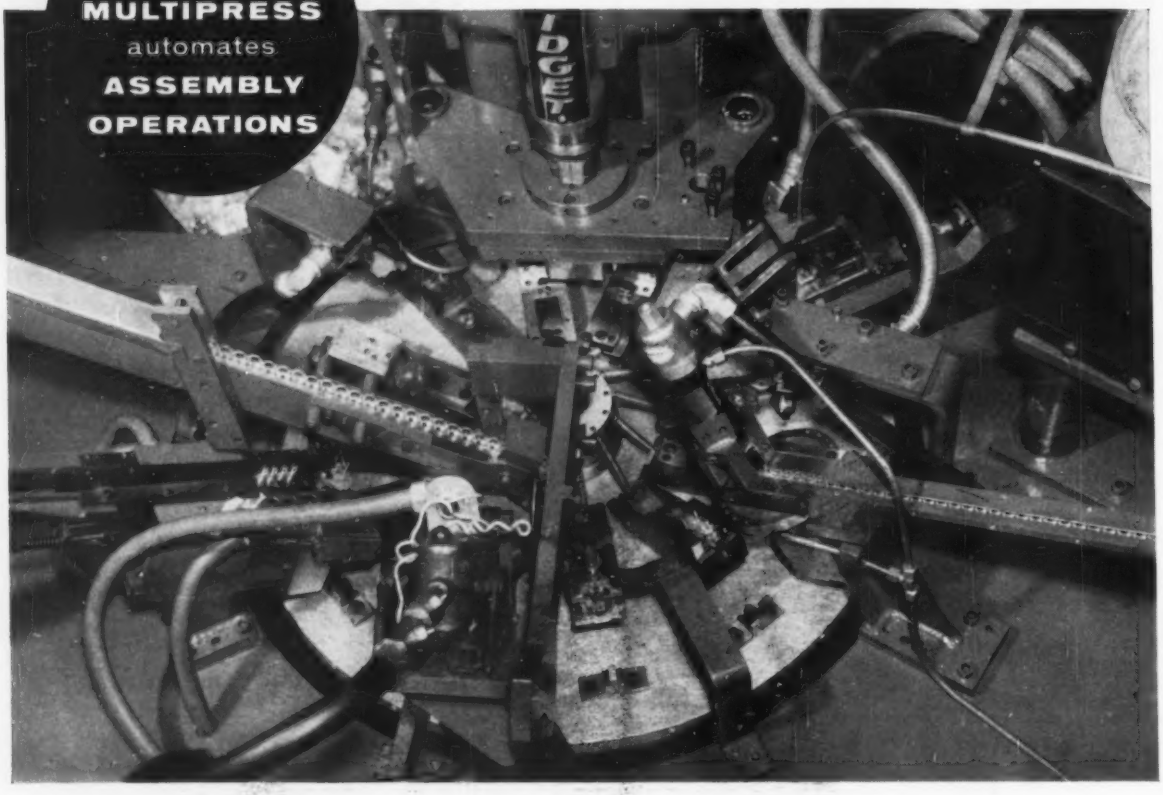
NATIONAL BROACH & MACHINE CO.

5600 ST. JEAN • DETROIT 13, MICHIGAN

WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

How **DENISON MULTIPRESS** automates **ASSEMBLY OPERATIONS**

45 assemblies-per-minute *are produced on this 1-ton Denison hydraulic Multipress and automatic index table at the Unique Balance Division, S. H. Pomeroy Company, Dubuque, Iowa.*



MULTIPRESS assembles and inspects complex 4-part components

...at a rate of 2700-per-hour

With this Denison hydraulic Multipress and feeding devices, production assembly of complex units has been increased and costs reduced considerably.

Completely automatic, the particular operation shown assembles and inspects the four-part assemblies at a rate of 45-per-minute... *2700-per-hour.* Any defective assemblies are automatically rejected. The operator has only to supervise the equipment and load component hoppers.

The automatic operation shown is typical of how multi-component assembly operations can be simplified with Denison hydraulic Multipress and simple tooling. The Denison field man near you can help analyze your work and demonstrate how you can duplicate these savings in your plant. Write for the Denison catalog describing the full line of Multipress units for your work.

4-part assembly *of spring tension unit for sash balances, used on double-hung windows to replace conventional sash cord and weight.*

Denison, Denison HydrOILics, and Multipress are registered trademarks of Denison Eng. Div., ABSCO

DENISON ENGINEERING DIVISION
American Brake Shoe Co.
1152 Dublin Road • Columbus 16, Ohio

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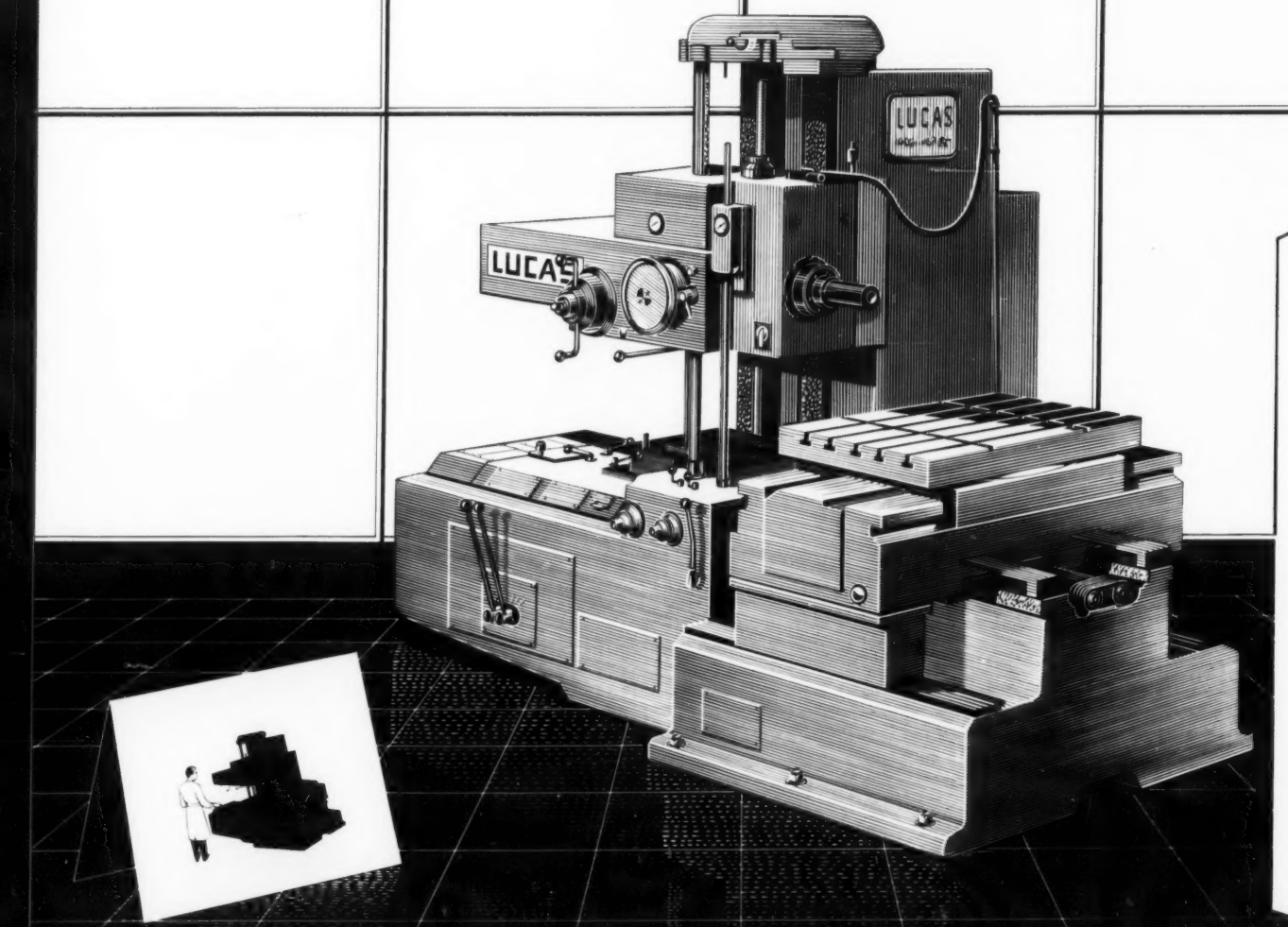
DENISON HydrOILics

HYDRAULIC PRESSES • PUMPS • MOTORS • CONTROLS

For more data, circle this page number on inquiry card

newest and smallest in a distinguished line

LUCAS OF CLEVELAND



The new Lucas Horizontal Boring, Milling and Drilling Machine offers all the quality construction features of the other fine precision machines in the Lucas line plus a built-in Rotary Table. This versatile little machine is made-to-order for production of small dies, fixtures, miniature electronic parts, machine casings, aircraft and missile parts and similar work. The inherent accuracy of the Lucas 275-40-RT suits it for a variety of post-production inspection operations. Air Lift to saddle and table. Constant-operating automatic lubrication. Spindle diameter 2.750″ or 3.000″. Spindle travel 18″. Vertical Head travel 24″. Cross travel 30″. Longitudinal Saddle travel 18″. Table 26″ x 30″. Spindle speeds 62-2000 rpm. Feeds from .0007″-.915″. Tape programming can be added as an optional feature. For complete information, write Lucas Machine Division, The New Britain Machine Company, 12302 Kirby Avenue, Cleveland 8, Ohio.

LUCAS plus "N. P. C."

Numerical Positioning Control on any Lucas machine presents advantages that contribute to more production, greater efficiency and a higher degree of accuracy. The individual advantages are as follows:

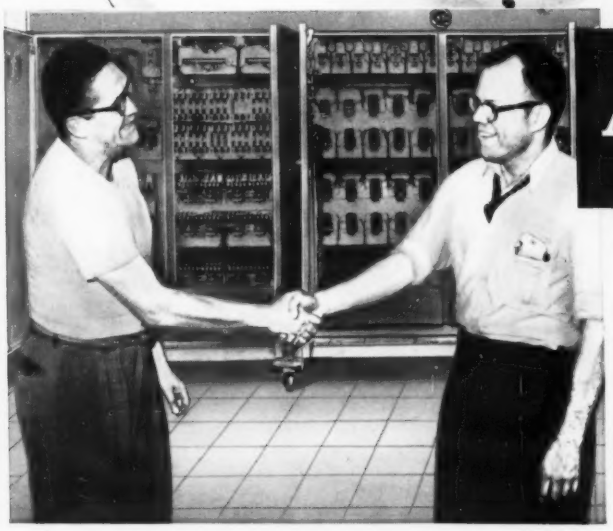
- Reduces direct and indirect labor
- Eliminates jigs and fixtures
- Eliminates scrap
- Controls production
- Improves quality
- Reduces inventory
- Reduces floor space
- Reduces tool costs
- Simplifies engineering methods
- Makes new methods possible
- Eliminates the human error

On all Lucas machines with N.P.C., the point to point positioning and changes of speeds and feeds may be controlled by manual selection of the decade switches on the console as well as by punched tape programming.

It will pay you well to investigate the possibilities which this combination offers in your plant. For complete information, write Lucas Machine Division, The New Britain Machine Company, 12302 Kirby Avenue, Cleveland 8, Ohio.

LUCAS
OF
CLEVELAND

Precision Guidance of Nearly a Mile of Plate Glass...



A series of control panels such as this is used in the Pittsburgh Plate Glass cutting room. Above are shown the Allen-Bradley engineers after completing the factory testing of the final panel.

controls by ALLEN-BRADLEY of course!

The New Pittsburgh Plate Glass Plant at Cumberland, Maryland, heralds a new era in the art of plate glass making. Night and day, a continuous ribbon of glass is fed to a nearly mile-long process line. Then a complex control system directs the automatic cutting, sorting, and conveying of the glass to six areas, according to a continuously varying program.

Special control panels which integrate portions of this equipment into a unified, smoothly operating system were designed, developed, and engineered by Allen-Bradley. You can benefit by this extensive control experience . . . it is a "plus" value when you specify Allen-Bradley *quality* motor control.

Allen-Bradley Co., 1316 S. Second St.
Milwaukee 4, Wis.
In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

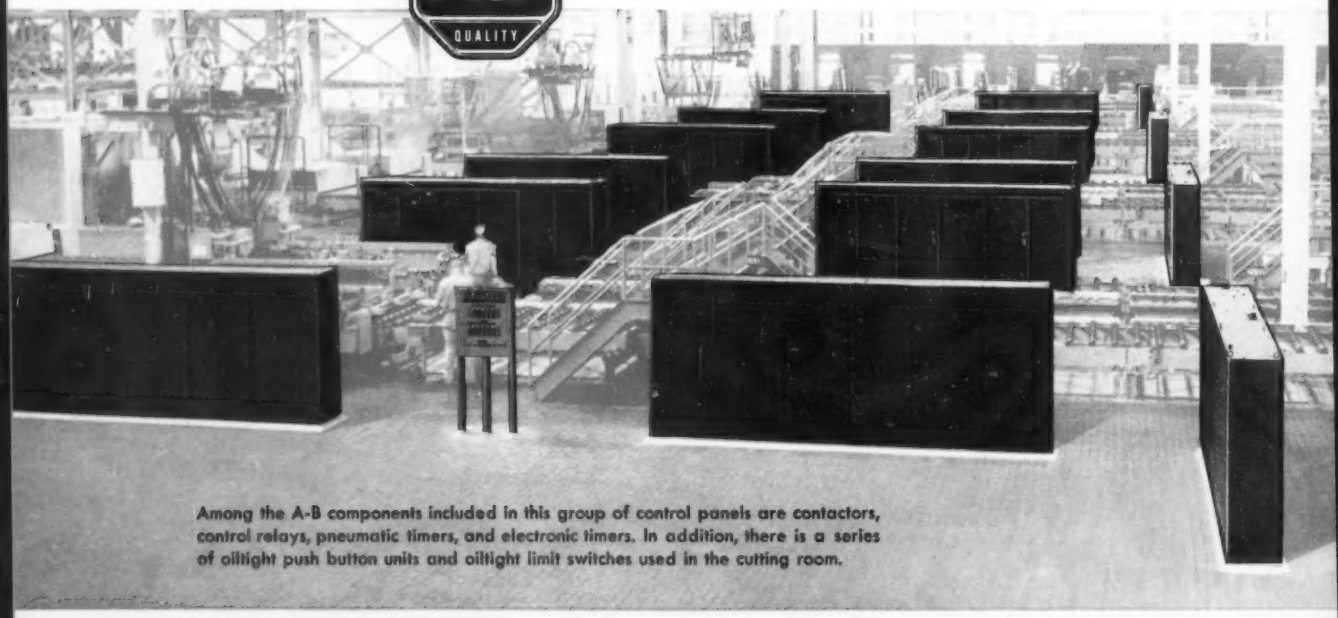
See on the next page how A-B Controls do it... →

5-59-MR

Plate Glass made by the mile

with reliable ALLEN-BRADLEY Controls

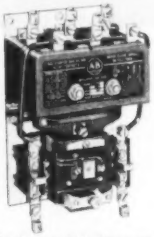
In the cutting room at Pittsburgh Plate Glass (below), Allen-Bradley controls prove the reliability of their "simple design." All A-B solenoid starters, contactors, and relays have only ONE moving part . . . assuring *millions* of trouble free operations. There are *no* bearings or jumpers to cause trouble. Contact maintenance is also eliminated—A-B double break, silver alloy contacts remain in perfect operating condition until completely worn away. Insist on Allen-Bradley *quality* motor controls . . . you cannot do better!



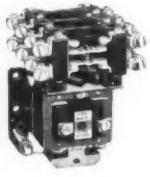
Among the A-B components included in this group of control panels are contactors, control relays, pneumatic timers, and electronic timers. In addition, there is a series of oiltight push button units and oiltight limit switches used in the cutting room.

Some of the standard components which are used in this plant

Contactor—Bulletin 702, Size 3 shown. Made up to Size 8, rated 1350 amps, 220-550 v.

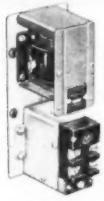


Solenoid Starter Bulletin 709, Size 2 shown. Made in ratings to 450 hp, 220v; 900 hp, 440-550 v.



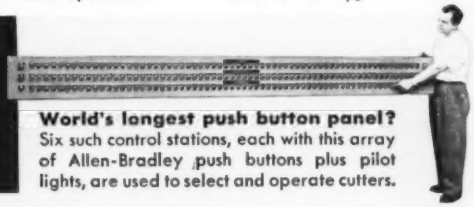
Control Relay—Bulletin 700. Universal type relay with both N.O. and N.C. contacts shown.

Limit Switch—Bulletin 802T. Oiltight roller lever type shown. Also with many other operators.



Pneumatic Timer Bulletin 849 for on-delay or off-delay. Range from 1/20 to 180 sec ±10%.

ALLEN-BRADLEY
Quality Motor Control



World's longest push button panel? Six such control stations, each with this array of Allen-Bradley push buttons plus pilot lights, are used to select and operate cutters.

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.
In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

5-59-MR

the objective in cost savings at BLAW-KNOX COMPANY

by—*W. Cordes Snyder, Jr.,* PRESIDENT

"The pressures to improve cost performance in all phases of a company's operations have been growing steadily over the years, and there is every indication that they will continue to mount. This is particularly true with respect to productivity at the manufacturing level, where a wise policy of replacement, additions, and modernization provides a sound basis for cost savings.

"At Blaw-Knox Company we keep this objective constantly in view, as set forth in the following company policy:

"It shall be the policy of the Company to continually examine its machine tools, equipment, and other facilities with a view to achieving the maximum return on investment by improving production, operating costs, product quality, and safety, and by maintaining its capital equipment at a high level of efficiency.

"The responsibility for close scrutiny of capital equipment is given to division managers who annually submit their requests for appropriations necessary to effectively carry out this policy.

"Naturally, the MAPI formula provides an excellent guide which management uses in making its decisions regarding capital replacement, additions, or modernization."

★

keep gathering metal-working production ideas . . . be well informed when you replace machinery . . . . . .

May, 1959

Rockford Insert Group

Mill Odd Shapes

...with Barber-Colman Form-Relieved Cutters

We don't expect you to have a job exactly like this . . .

. . . but the manner in which cutter design was established may illustrate important benefits gained by submitting part prints to the Barber-Colman Tooling Service.

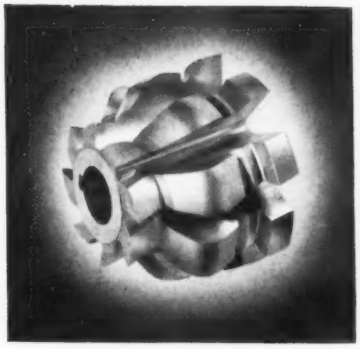
Whether you have irregular forms or a combination of straight surfaces to machine, a comprehensive engineering analysis will help you determine the one best cutter for increasing accuracy and combining operations economically.

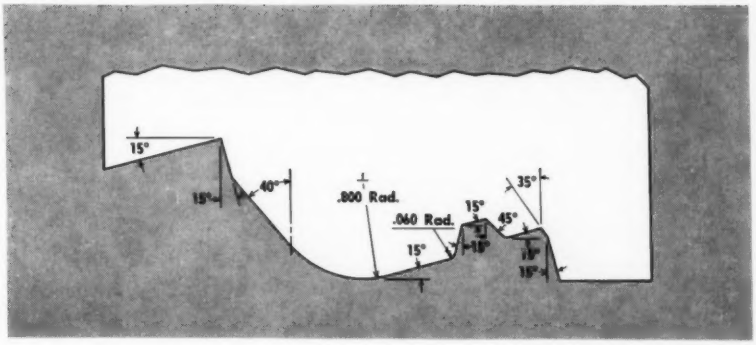
Electronic computer aids cutter design

This cutter requires a 10° helix and a 10° positive radial rake to produce the accuracy and smooth finish on the part. The helical flutes and radial rake make it necessary to calculate the cutter tooth form which will produce the desired part form. All plot points, formerly obtained manually, were determined rapidly and accurately on a Bendix computer. Only the points where a change in form

MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

in One Operation





occurs were obtained manually. Over 60 other points were determined quickly by the computer.

An electronic computer has the following advantages for you:

1. *Accurate cutters* — A direct solution is possible through the application of mathematical formulas which eliminate trial-and-error solutions. The great number of plot points which can be determined quickly and accurately assures exact duplication of complex shapes.
2. *Economical design* — You get the highest possible number of engineering man-hours devoted to actual development of the cutter because fewer hours are required to work out details.
3. *Faster service* — Speed of computation permits us to check a number of designs and still meet reasonable delivery schedules.
4. *Flexibility to change* — All variables other than form, such as helix angle, side clearance, number of teeth, cam, diameter, rake, etc., can be changed at any stage of engineering without rigidity at our end. There's no incentive to "save" a design should a different helix angle or diameter be desired.

Design of this cutter included a cutting clearance problem. If the part were set square with the cutter, a two-piece cutter with axial relief in both directions would be required. However, by tipping the part at 15°, a one-piece cutter can be used.

Let us analyze your milling operations

The Barber-Colman Tooling Service is the most complete milling cutter facility available under one roof. Your part drawing can be evaluated in terms of every cutter style, for which we have complete manufacturing facilities: (1) standard or special cutters, or a combination of these in a gang; (2) high-speed steel or carbide-tipped; (3) eccentric-relieved or profile-type; and (4) ground or unground form.

There is a lot of wisdom in rechecking operations periodically in terms of new tooling and methods. This is not a difficult or costly thing to do. Yet it may reveal golden opportunities to tighten up tolerances, improve surface finish, or reduce manufacturing costs. It may be on a time-consuming planer job, a series of flat-surface milling operations, complex form milling, or even new pieceparts.

How about putting the Barber-Colman Tooling Service to the test? It will cost nothing to submit part prints or discuss your jobs personally with a Tooling Specialist. We're ready any time you are. Call your nearest Barber-Colman field office or the factory — TR 7-5741.

Barber-Colman Company

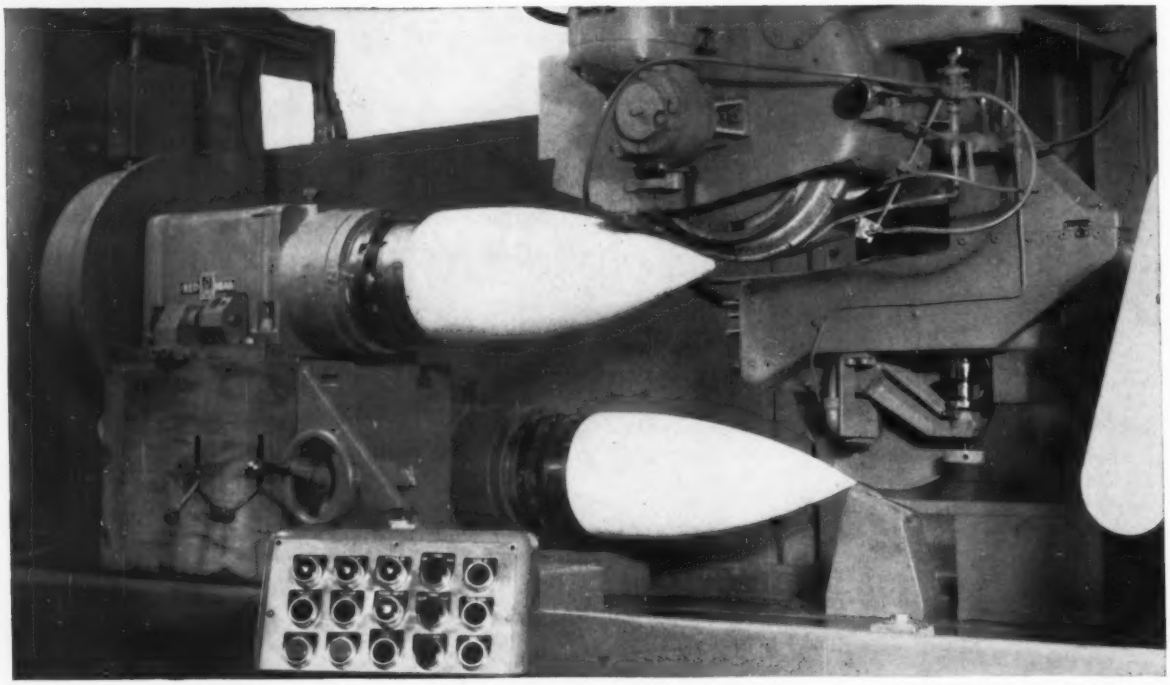
BARBER COLMAN ®

52 Loomis Street, Rockford, Illinois

CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**

MATTISON
HIGH-POWERED PRECISION
GRINDING METHODS

New method of duplicating extremely accurate forms



Tracer-controlled grinder combines heavy cuts, close tolerances on super-hard ceramic nose cones

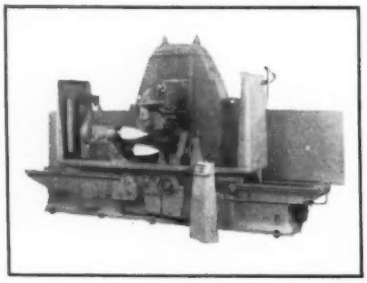
Looking for an accurate method of duplicating complex workpieces with a minimum of engineering, fixturing, or setup costs? This tracer-controlled surface grinder developed by Mattison in co-operation with a leading missile manufacturer may be the answer.

Missile engineers wanted a grinder that could remove up to .400 in. of super-hard skin from ceramic nose cones and still maintain critical wall thickness. The grinding wheel had to take a series of curvilinear cuts around an elliptically shaped cone. Wheel path had to be longitudinal to eliminate "banding" and minimize friction when the missile was in flight. The manufacturer wanted a machine that could be converted easily from missile requirements to conventional work.

Mattison started with a standard 30 x 30 x 72 in. horizontal-spindle grinder. On rugged jobs that put a premium on rigidity, this machine is made to order—its rigid double-column supports, heavy wheel housing, and solid, one-piece bed virtually eliminate all deflection and vibration, even under hogging cuts.

To this was added a direct, hydraulic, transfer-type tracer for smooth, stepless positioning of the grinding head.

In operation, table feed moves the tracer longitudinally over a precision-ground, hand-lapped master cone, transmitting the form to the grinding head. A diamond wheel "mirrors" tracer motions, takes successive cuts (up to .070 in. per pass) until cone is completed.



Although it is used here with a round master, the tracer works equally well on flat templates. For transverse cuts, the tracer wheel (or stylus) can be swung 90° and fed across the template using head cross-feed.

If *your* jobs require duplicating extremely accurate forms, why not investigate tracer-controlled grinding?

See Quick-Tilt surface grinding

On the new Quick-Tilt vertical-spindle surface grinder we are producing perfect cross-hatch finishes on large uninterrupted surfaces. We can show you production savings and accuracy improvements on test jobs or your own piece-parts. For all arrangements see your dealer or call:

MATTISON MACHINE WORKS
Rockford, Illinois • Phone WO 2-5521

MATTISON MACHINE WORKS

HIGH-POWERED PRECISION SURFACE GRINDERS

MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

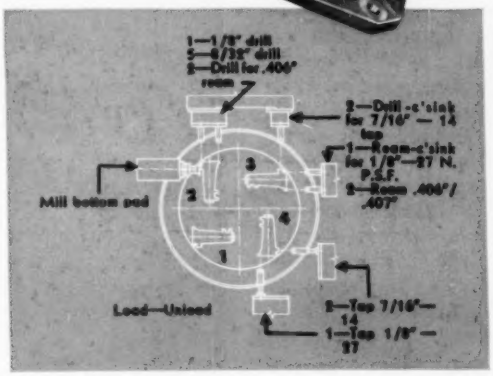
W. F. & JOHN BARNES

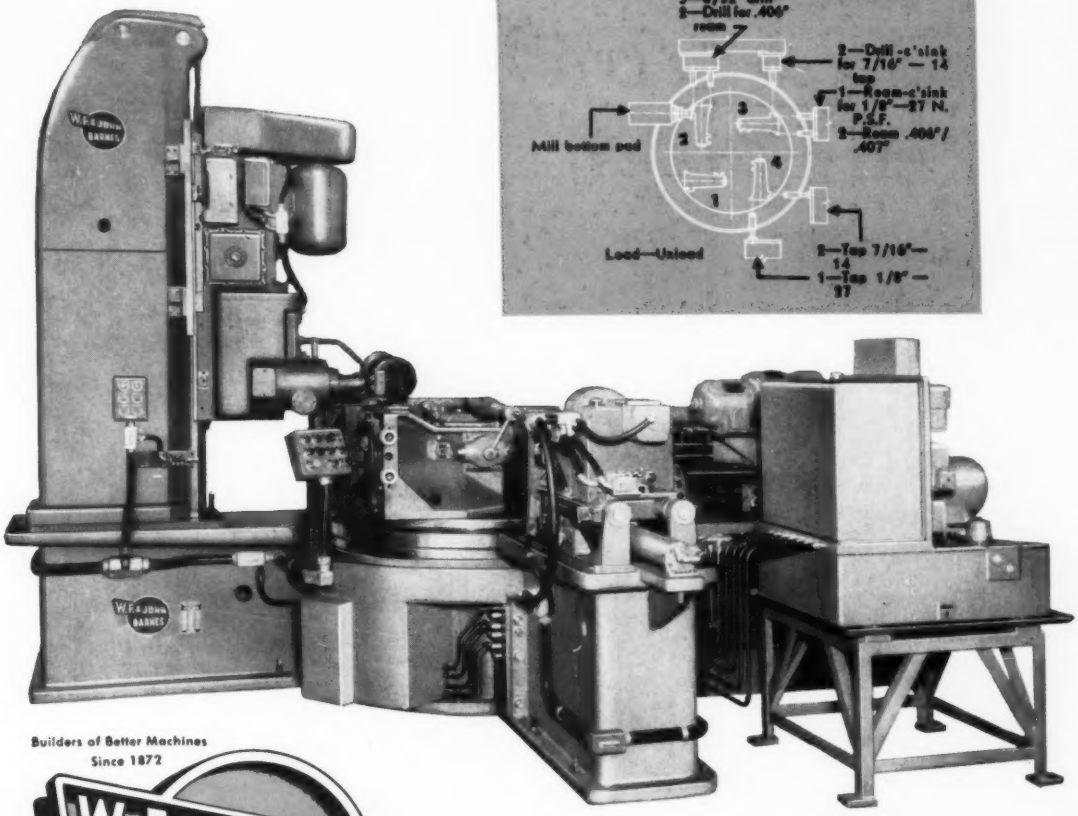
4 station special

HANDLES 17 MACHINING OPERATIONS, SAVES FLOOR SPACE

Here is another cost-cutting example of a special machine engineered by W. F. and John Barnes that provides both an efficient machining method and the means to save valuable floor space. A total of 17 operations on the cast aluminum transmission housing, illustrated at right, are performed at a gross production rate of 118 pieces per hour. Operator handles both loading and unloading while parts are processed at the three machining stations. A 48" diameter hydraulic table indexes the work from one station to another. Compactness of the machine's design conserves floor space, yet ample room is provided for easy accessibility to working heads.

Cast aluminum transmission housing





Builders of Better Machines
Since 1872

W. F. & JOHN BARNES

ASK FOR AN ANALYSIS OF YOUR MACHINING METHODS — For assistance with machining problems ask a Barnes Engineer to work with you. Ask for a copy of "Coordinated Machine Engineering" — tells how Barnes 6-point machine building service saves time, eliminates divided responsibility.

W. F. & JOHN BARNES COMPANY

402 SOUTH WATER STREET • ROCKFORD, ILLINOIS

Multiple Spindle Drilling • Boring • Tapping Machines • Automatic Progress Thru Transfer-Type Machines

FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**

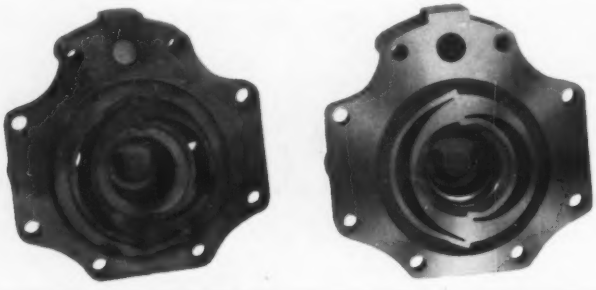
SUNDSTRAND

"ENGINEERED PRODUCTION" NEWS

Automatic Lathe Precision Bores and Faces at Twice the Former Rate

Special tooling on this Sundstrand automatic lathe boosted production of pump housings to double that formerly produced on conventional precision boring equipment. The lathe is set up to bore and cross face the pump housing with the tool on the front slide and, with an additional tool on an overhead slide, face the open end all in one automatic cycle. Precision setting of the tools and slide makes possible the extremely close boring limits and flatness in relation to the bore. Six different sizes of pump housings are handled on this one machine with production runs averaging approximately 200 pieces.

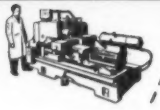
When tolerances are close and production runs of moderate length, that's a situation made to order for Sundstrand "Engineered Production." The processing, machine design, and tooling skills put to work to find not only a "better than before" but a "best" solution, are your guarantee of success. Solutions like this one, that eliminate the need for a second operation machine, keep the capital investment at a minimum, too. Because Sundstrand builds a complete range of automatic and tracer turning equipment, including complete lines incorporating automatic handling, you are sure to get the best equipment for your job. Semi-standard machines using a high percentage of standard components hold down engineering and over all machine costs.

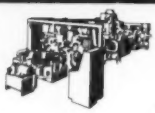
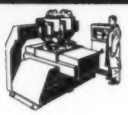


Additional information on Sundstrand solutions to every type of turning problem is contained in bulletin titled "Engineered Turning Production." Write today for your copy.

AUTOMATIC LATHES · RIGIDMILS · SPECIAL MACHINES · DRILLING MACHINES · GRINDERS

SUNDSTRAND

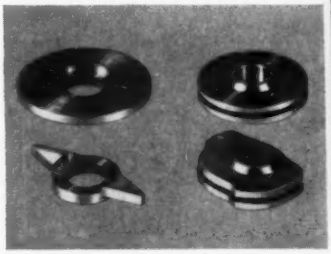


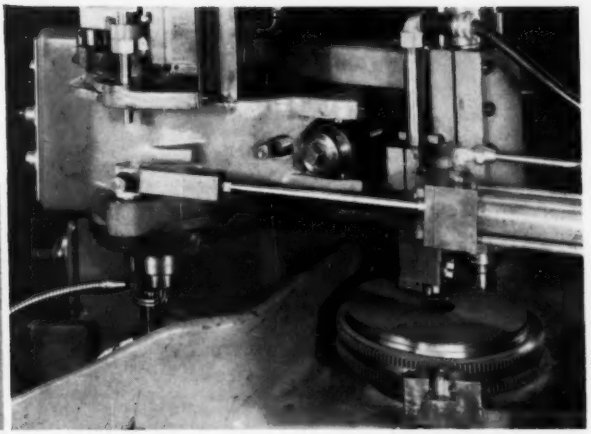



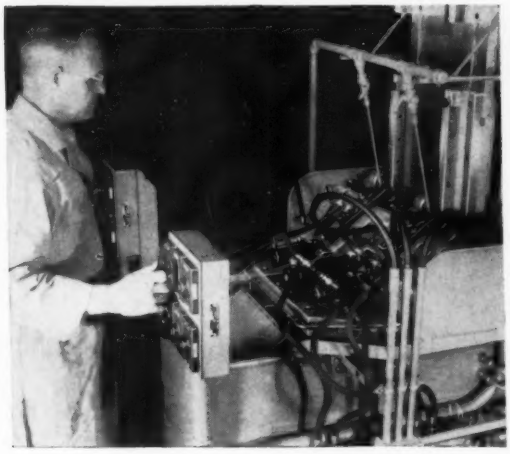
CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

Cam Contour Mill Handles a Wide Range of Work

Almost any part up to 5-in. diameter and requiring contour milling can be machined automatically on this standard cam controlled Sundstrand machine. Parts with either internal or external contours are produced on this single machine for such varied end products as business machines, governors, ordinance equipment, etc. Sundstrand Contour Mill has one vertical cutter spindle and one cam follower spindle mounted together on a pivoting arm. Ratio between cam roller arm and cutter arm is 2 to 1, reducing any possible cam error ½ on the finished part. Cutter spindle is driven by "vee" belt from a ¾ hp variable speed drive producing infinitely adjustable speeds from 400 to 2500 rpm. Up to 24 different machine cycles are possible on one standard machine with all cycle changes made by pushbutton control.







Two Surfaces 70 Degrees Apart Broached in One Stroke

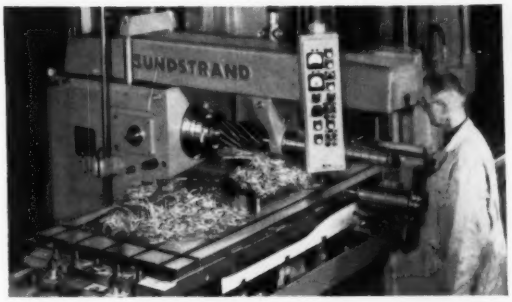
A two position fixture plus a specially designed surface broach enable this Sundstrand broaching machine to maintain high production of steering knuckle supports. The two pads being broached are 70° apart so the two broaches are mounted in a vertical line with a gap of 12" between them. The parts are clamped automatically, move forward into broaching position on the receding worktable, and tilt forward 70° automatically after the first broach has passed so that second surface can be finished. This job illustrates the benefits that can be derived from using Sundstrand as the single responsible source to provide the broaching tools, fixturing, and machine.

Tracer Equipped Rigidmil Cuts Job Times Up to 75%

The Sundstrand C-5 Rigidmil equipped for tracer milling lost no time in effecting major savings when put on the job machining tool steel. Here are the savings on two typical jobs with lower setup time providing an extra benefit.

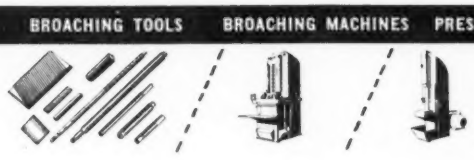
Job No. 1 — Part 12 in. wide, 36 in. long requiring up to 1¾ in. of stock removal. Total cutting time of 4 hours compared to 12 hours by the previous method results in a saving of over 67%.

Job No. 2 — Part 4 in. wide, 24 in. long, up to 1 in. of stock to be removed, 30° incline, 12 in. long. Total cutting time reduced to 2¼ hours from 9 hours formerly, a saving of 75%.



Want more milling facts? Write today for your copy of bulletin 603. "Engineered Milling Production"

BROACHING TOOLS BROACHING MACHINES PRESSES



SUNDSTRAND
MACHINE TOOL CO.
2530 Eleventh St. • Rockford, Ill., U.S.A.

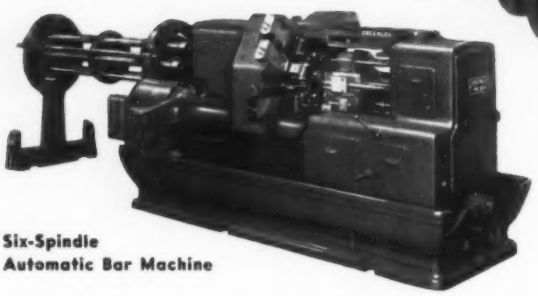
FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**

GREENLEE MILLING ATTACHMENT

PRODUCTION MACHINERY

GREENLEE

PERFORMS A VARIETY OF MILLING OPERATIONS



Six-Spindle
Automatic Bar Machine

Mounts on Main Tool Slide

The Greenlee milling attachment eliminates second operation milling on many jobs. Two millers, normally mounted in 3rd and 4th positions, can profitably mill squares or double slot end of work piece at bar automatic speeds. The cutter head rotates at the same RPM as the work piece. Cutter speed is independent of spindle speeds. The Greenlee milling attachment is only one of many versatile standard and special attachments that expand your job range . . . increase your profits. Find out how Greenlee attachments can help you. Get the details from your Greenlee Distributor.

Write for your copy of Catalog A-405 — first step on the way to more profitable production with Greenlee Automatic Bar Machines.

OTHER GREENLEE ATTACHMENTS AVAILABLE

- Eccentric Boring
- Eccentric Drilling
- Eccentric Forming
- Eccentric Turning
- Crimping
- Gear-Fed Reaming
- Relieved Type Facing
- Thread Rolling
- Broaching
- Trepanning
- Hollow Milling
- Burring

GREENLEE STANDARD AND SPECIAL MACHINE TOOLS

- Multiple-Spindle Drilling and Tapping Machines
- Transfer-Type Processing Machines
- Six and Four-Spindle Automatic Bar Machines
- Hydro-Borer Precision Boring Machines
- Die Casting Machines

GREENLEE
BROS. & CO.

1754 MASON AVE.
ROCKFORD, ILL.

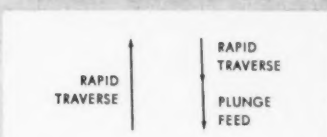
CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

How to increase productivity with...

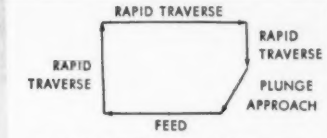
Multicycle Hobbing

Any one of these automatic cycles can be selected simply by turning a switch on the control panel.

SQUARE CYCLE – automatic version of the conventional hobbing cycle.



PLUNGE CYCLE – automatic vertical feed for cutting worm gears.



PLUNGE-APPROACH CYCLE – combination of "plunge" and "square."

Automatic cycling plus the opportunity to greatly reduce approach time in many cases makes the Multicycle version of the Barber-Colman No. 16-16 Hobbing Machine a high-production machine, and yet it is extremely versatile.

Reduce approach time

The new Multicycle machine offers three different automatic cycles (see sketch). Any of these can be selected simply by turning a switch. With the plunge-approach cycle for cutting helical gears and worms (or when using large, multiple-thread hobs), you can greatly reduce long approach time. With the push of a button, cam vertical feed and conventional horizontal feed cycle automatically. The hob starts cutting at full depth faster. Clamping and unclamping of the workslide is automatic. The operator just loads and unloads the work.

Automatic machines can be versatile, too!

To cut worm gears, turn the selector switch to "plunge," disengage the feed change gears, turn the dial control to proper cam speed, set the vertical stops, and push the start button. The workslide lowers rapidly to the cutting position. The work feeds slowly to full depth as it is being hobbed, and then dwells for the desired number of revolutions. When the hob stops, the workslide returns to starting position.

Is there a Multicycle machine for you?

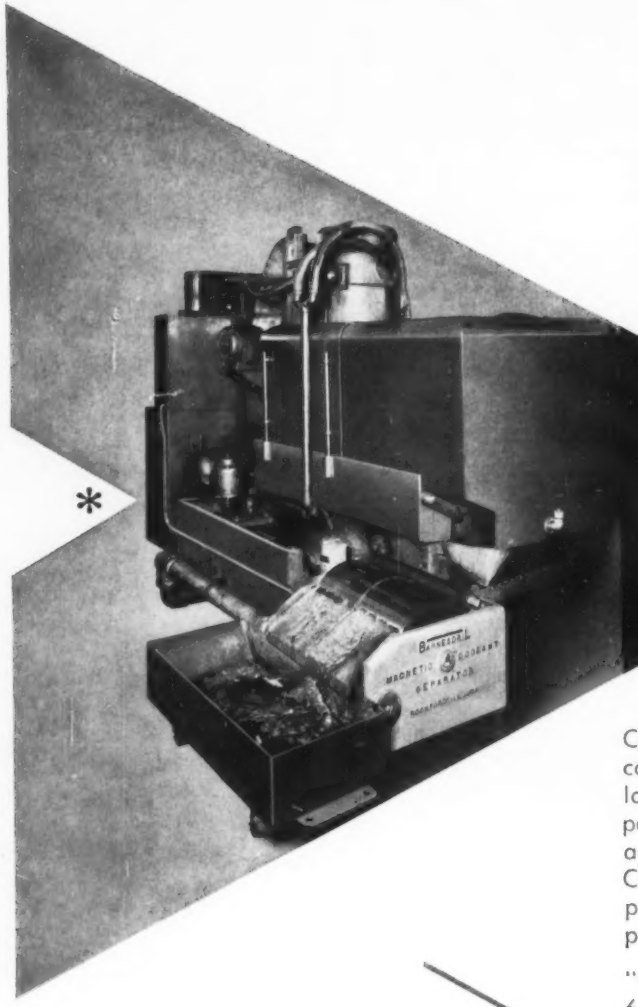
You bet there is. These same features are available in the No. 6-10 machine. Additional equipment, such as differential gearing, accessory vertical feed cams, and even full automation, will adapt this precision hobbing machine to almost any job. Send us prints of your gears. We'll give you a complete report on the time saved by a Multicycle machine. Call your nearest Barber-Colman field office or the factory, WO 8-6833.

Barber-Colman Company

BARBER COLMAN

52 Loomis Street, Rockford, Illinois

CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**



BARNESDRIL COOLANT CLEANING UNITS

CUT maintenance, labor costs

INCREASE PRODUCTION!

Coolant fed into a BarnesdriL magnetic coolant separator continuously circulates around the drum of powerful permanent Alnico magnets. Swarf, chips, and other ferrous particles are removed. Coolant is cleaned by the separator, thus preventing machine downtime and improving finishes.

a user reports:

"Our surface grinder (above) required 6 hours of cleaning and 5 gallons of coolant per week. With the BarnesdriL magnetic separator installed, there has been no downtime in 4 months and coolant used has dropped to 1 gallon per week. *We cut our grinding costs $65.50 per week.* Paid for the installation in less than 2 months."

These savings are typical. Call your BarnesdriL Factory Representative today or write for Catalog 300.

*BarnesdriL Magnetic Separator #4 installed on a Blanchard No. 18 Surface Grinder.

BARNES DRILL CO.

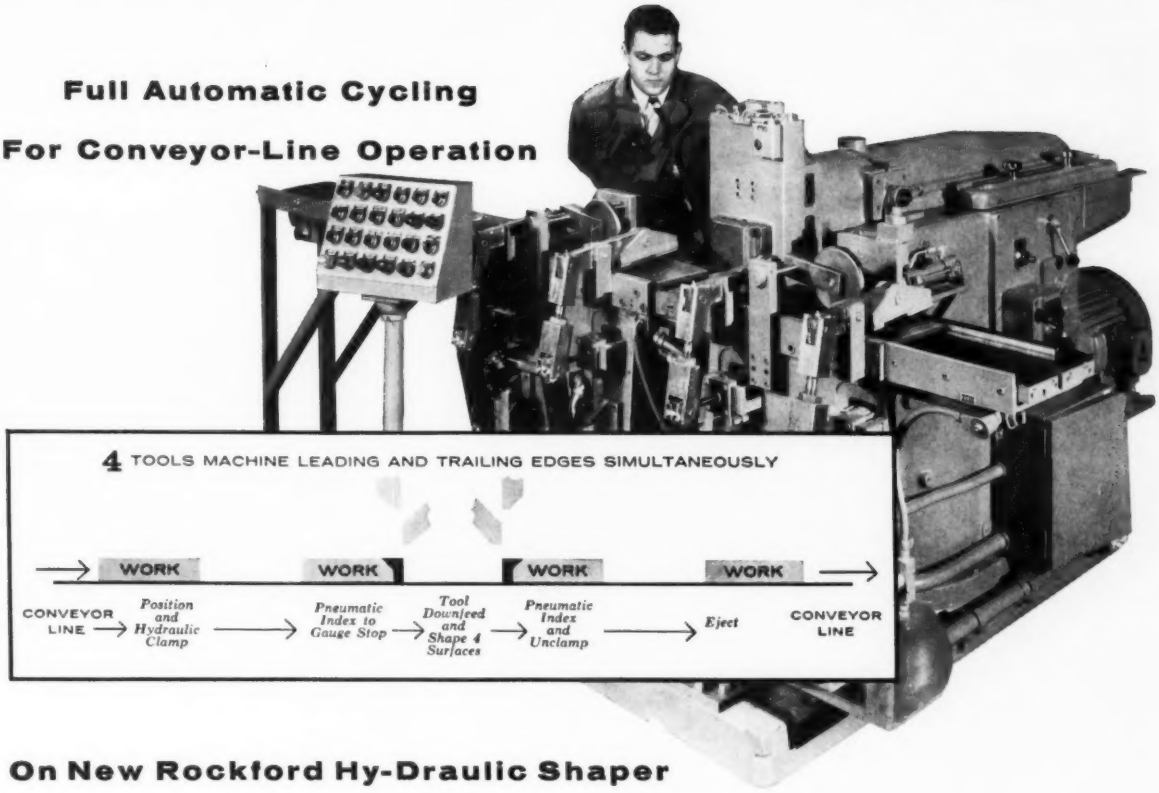
820 CHESTNUT STREET • ROCKFORD, ILLINOIS
DETROIT OFFICE: 13121 Puritan Avenue

CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

Now... automation comes to shaping!

Full Automatic Cycling

For Conveyor-Line Operation



On New Rockford Hy-Draulic Shaper

Believed to be the first automatic shaper built, this standard 24" shaper with special tool head and cross-rail has been adapted to conveyor-line operation by arranging completely automatic cycling, including loading and unloading.

With this new method, many types of flat plates may be machined accurately and efficiently at high production rates, saving costly cutting tools and extra fixturing expense.

Four standard high speed steel tool bits with identical grinds are used to finish one vertical and one angular surface of each of 2 pieces simultaneously, as shown in diagramatic sketch of the automatic cycle. The machine features pneumatic index, hydraulic positioning and clamping, and positive mechanical feed. Operation is continuous until machine is stopped by operator, or automatic safety devices reject the cycle sequence.

This type of automatic machining has many variations, using Rockford Hy-Draulic Shapers. If you have high output requirements for work which lends itself to this type of machining, send us blueprints for estimates and recommendations.

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. . . states Mr. Creighton Blanchard, toolroom superintendent at New Hampshire Ball Bearings, Inc., Peterborough, New Hampshire

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SURFACE GRINDER

is winning enthusiastic approval wherever precision work is required

Here's what Mr. Blanchard has to say about the new Type D machine:

"We have three grinders in our toolroom—a Thompson and two competing machines. In our general toolroom grinding, especially on carbide and hard metals, we find the Thompson Type D so superior that we have recently purchased another Thompson just like it. All our precision work goes on the Thompson."

Compare these features

- Steel roller anti-friction slides eliminate ball creep and increase rigidity.
- 14" standard vertical capacity under 7" wheel at no extra cost with no loss in vertical capacity when using wet attachment.
- Solid support through entire length of bearing quill assures extra fine finish.
- 5 inch table movement per turn of handwheel improves quality of finish and speeds up operations.
- No backlash, anti-friction ball nuts and screws on cross feed prevent wheel from creeping away from work in shoulder grinding.
- Swing-out stop for table dog contact permits quick movement to wheel dresser.
- Immediate delivery available.

Send for descriptive literature on the new Thompson Type D Grinder.

THE THOMPSON GRINDER CO.
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"Keep Thompson in mind for that daily grind"

Thompson SURFACE GRINDERS

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peeling machine

hot ingot

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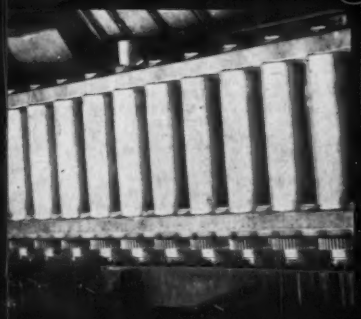
works in milan (italy)



The hot ingot peeling performed with the special Innocenti milling machine eliminates all the inconveniences connected with the old manual and mechanical systems. The hot milling of the scale by means of a controlled peeling operation affords a technically perfect result which is also economically advantageous. The complete cooling of the ingot between stripping and conditioning is eliminated together with the cracking danger and the annealing necessary to bring the ingot to rolling temperature. After the stripping, the ingot goes to the milling position where is peeled on one side. A manipulator turns over the ingot until all sides one after the other have been peeled. The ingot returns to roller table and thereafter goes to the soaking pits and the roughing mill. The machine is operated automatically, hydraulic controls and safety devices allow a safe and practical use. All types of carbon, alloy and stainless steel can be conditioned without changes in working time. This represents a noticeable improvement as compared with the old systems where the conditioning of alloy ingots was from 2 to 10 times longer than the basic time allowed for carbon steel.

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EXTRA DEEP THROAT "C" CLAMPS

Provide extra clearance required for some work. Extremely stiff for weight. Screws and hubs are accurately machined and aligned with machined seats; have sliding pin handles and free-acting swivel caps on point. Bodies have smooth sandblast finish.
(8 sizes to 12" opening)

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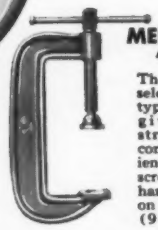

MEDIUM SERVICE "C" CLAMPS

The design and careful selection of steels in this type clamp combine to give it maximum strength and stiffness consistent with convenient weight. Heat treated screw with sliding pin handle and swivel cap on point. Ground seat.
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TOOL MAKERS "C" CLAMPS

Quality steels, drop forged, heat treated and accurately machined with ground seats. Drop forged screws have both "wing nut" handle for convenience and square necks for tight setting with a wrench. Either "plain" or "swivel" screw types.
(Four sizes: 1", 2", 3" or 4" maximum opening)

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Extra Deep Throat Pattern (see above). Body, Swivel and Screw are cadmium plated over all to resist welding spatter.
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Jaws drop forged, carefully machined and hardened, are extra heavy; will not bend or spring on a short bite and are faced true. Will grip non-parallel surfaces because the under face of the center screw is convex, fitting into a concave seat for tilting.
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PARALLEL CLAMPS

Carefully machined from selected grade steel and hardened. Particularly suited for holding work together when drilling or tapping. Rounded jaw ends increase clearance in close quarters. Spring clip holds loose pin in alignment while tightening or loosening.
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(Not Drop Forged)

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Now in daily operation at the Truarc Retaining Rings Division of Waldes-Kohinoor, Inc., of Long Island City, New York, this new Bliss High Production Press is running at the blurring speed of 1000 strokes a minute, hour after hour, day after day. First of its kind, this completely new press has a revolutionary counterbalancing system and massive, close tolerance construction that virtually eliminate vibration, even at this phenomenal speed. Could a press like this cut your parts cost...add to your profit picture? We'll be glad to give you the facts.

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Two men normally work at the press, and each is provided with a set of control buttons. As a safety measure, two "run" buttons requiring both hands of the two men, must be depressed to operate the machine.

This machine has air-electric control which eliminates the need of any cross shafting at front for mechanical foot treadles. Air-electric control makes push-button operation possible and provides fast, positive clutch and brake action.

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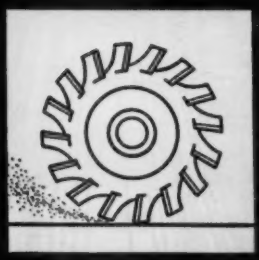

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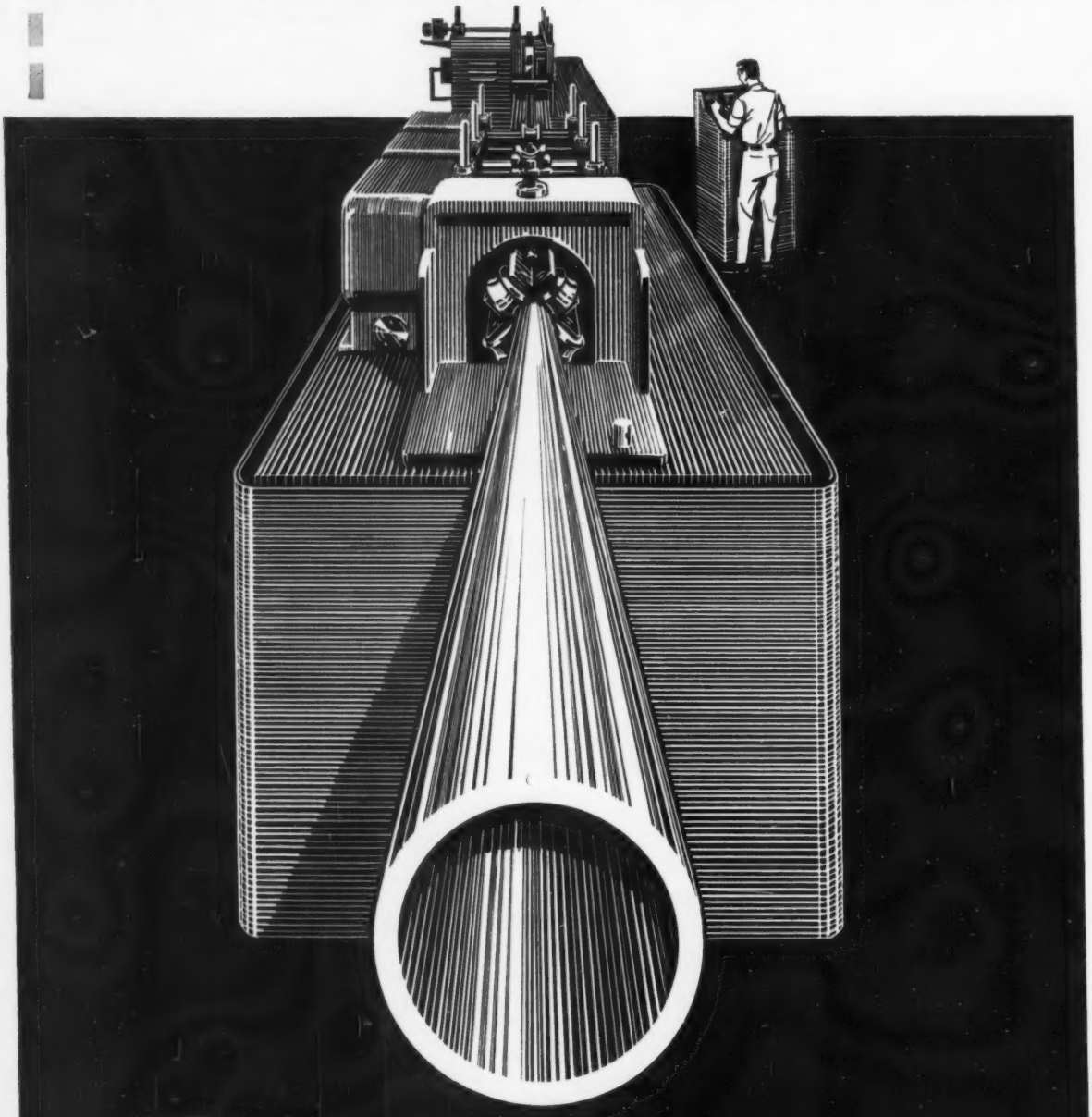

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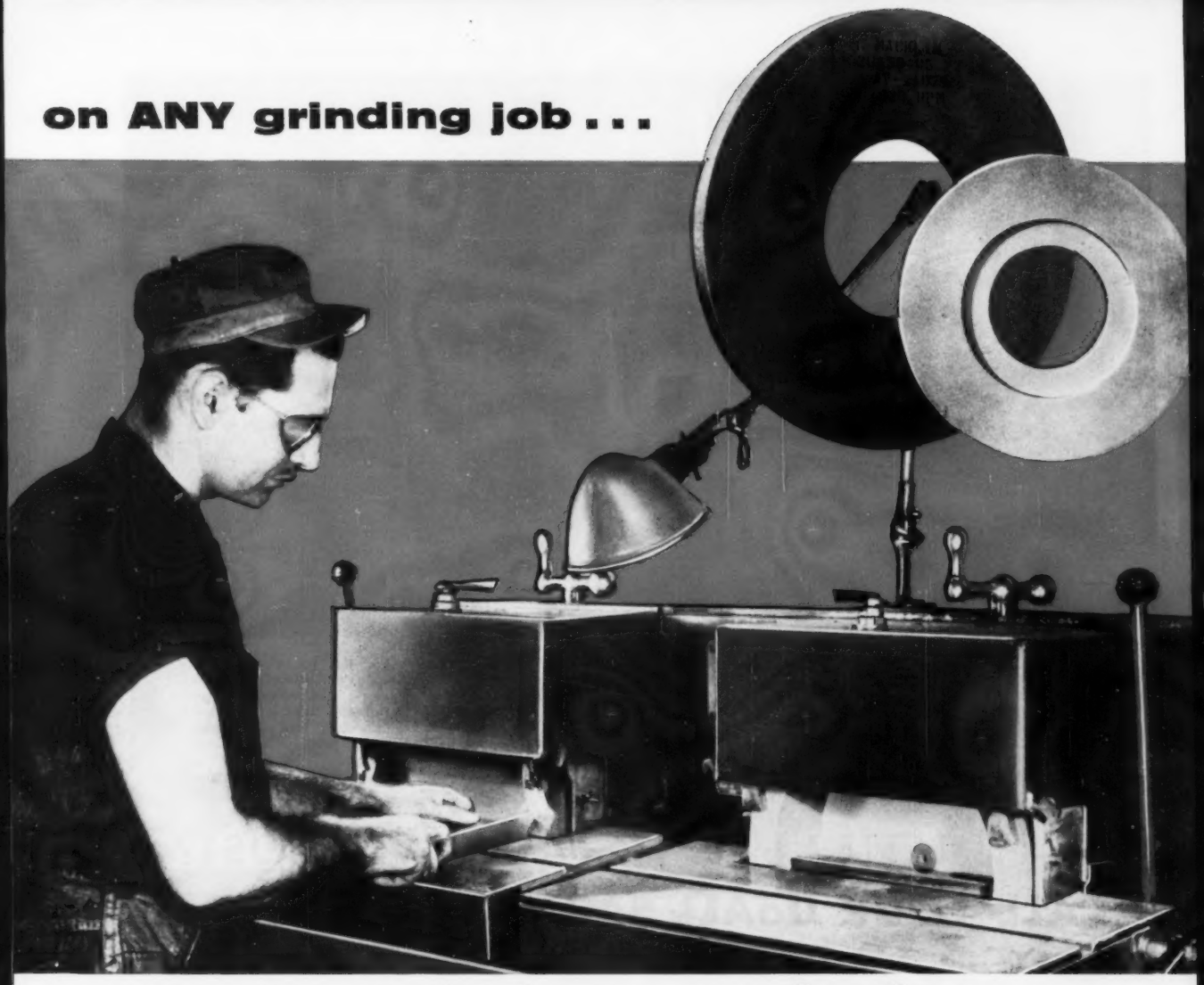

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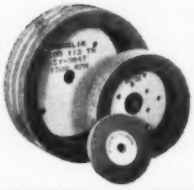
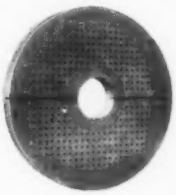
with MACKLIN *"Wheels of Profit"*





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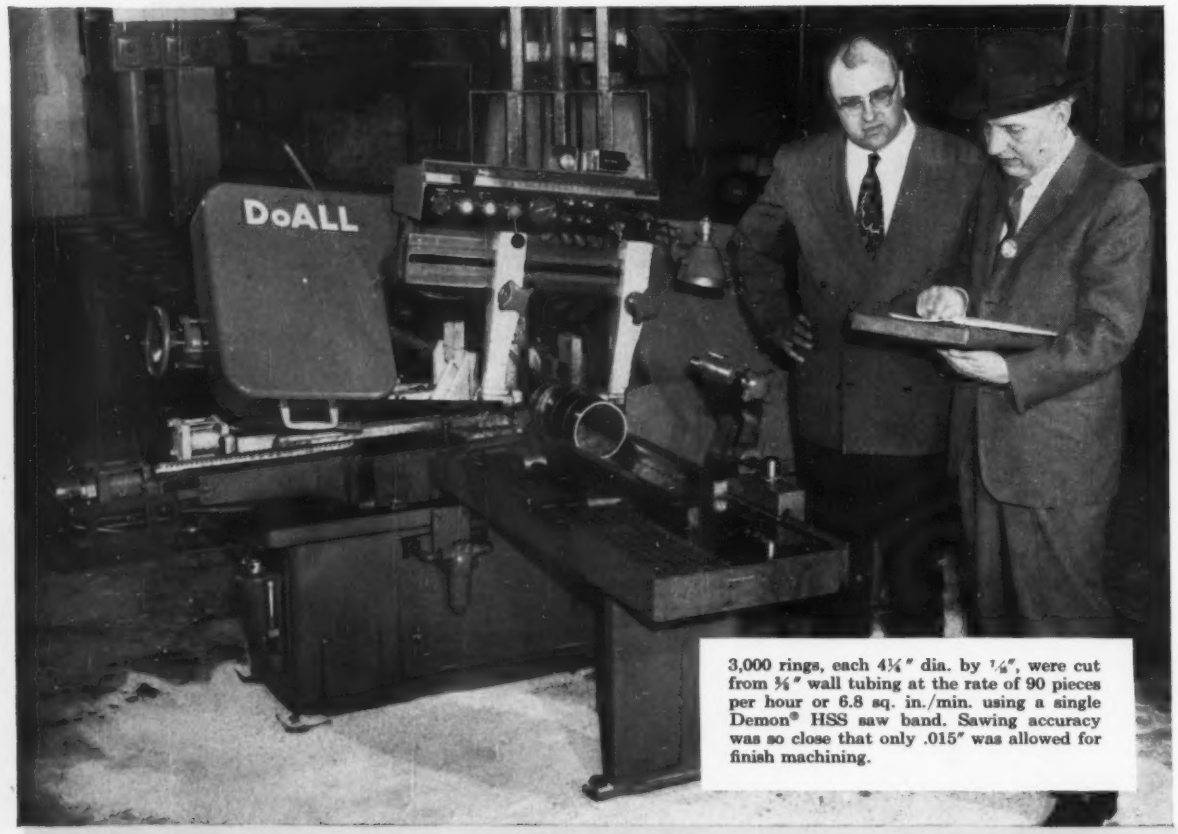

3,000 rings, each 4¼" dia. by ⅛", were cut from ⅜" wall tubing at the rate of 90 pieces per hour or 6.8 sq. in./min. using a single Demon® HSS saw band. Sawing accuracy was so close that only .015" was allowed for finish machining.

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CALL YOUR DoALL SAWING SPECIALIST

Your band sawing costs can be materially reduced when both machine and blade work together as a team. Because only DoALL makes both machines and blades, only your DoALL Sawing Specialist can match them for top efficiency. Here's a typical case:

When Fred Hall, Sawing Specialist of DoALL Twin Cities Company, was called in by Clarence LaMott of Precision Products Mfg. Co., Minneapolis, he was able to solve the difficult sawing problem described in the photo above. He recommended the proper band tool, feed, speed, and coolant for maximum production at the lowest possible cost.

Back of Fred Hall and every one of the 200 DoALL Sawing Specialists are: (1) the accumulated experience of the leader in the band tool cutting field, (2) the services of the DoALL Sawing Research Laboratory for solving difficult cutting problems, and (3) the largest assortment of band tools made—18 types and over 300 width-pitch-set combinations.

There's a complete sawing service near you. It's your local DoALL Sales-Service Store, which has everything you need to help you get more for your band-sawing dollar. Its expert help is *free*, so call today or write—

SB-67

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The DoALL Company, Des Plaines, Illinois

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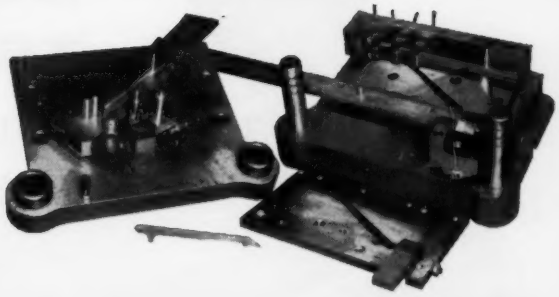

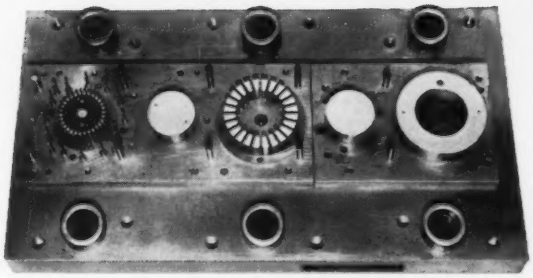

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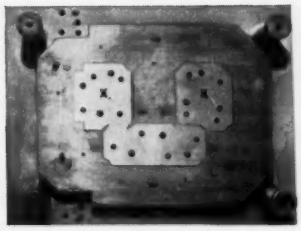

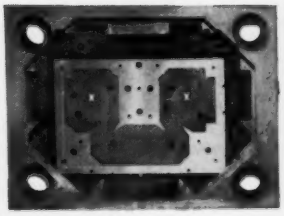

These are the most profitable cold work die steels at the disposal of the diemaker today, in down-to-earth *performance per dollar per pound*. Each is an air-hardening grade, each has its unbeatable area of application. Only three names to remember —AIR HARD, OHIO DIE, CROCAR— and you've got it made! *Check us for the technical data you can use.*

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SKINNER DUCTILE IRON TROUGH VISES

are more rigid, stronger . . . and tougher!

● Thanks to the use of a unique new metal, ductile iron, these new Skinner milling machine trough vises have *extra* strength to resist cracking, *extra* toughness to take abuse, *extra* hardness to withstand heavy blows, and *extra* rigidity for extreme accuracy and holding power. They vibrate less, too . . . reducing scrap and tool breakage. You can expect these new Skinner D-I-T vises to hold up longer in service than any other construction and to require a minimum of maintenance.

The holding capacity of these vises is equal to the full width of the jaws. And the precision-machined jaws are rugged enough to hold work under the severest conditions. A flat, smooth body keeps chips from getting under the movable jaw. And a large trough guides the coolant to return – keeps it from slopping over. A square lock construction provides additional rigidity.

Jaw widths: 4″, 5″, 6″, 7″, 8″. Optional swivel base for setting vise at any angle through 360° in a horizontal plane.

Skinner Vises and Chucks are available nationally from leading Industrial Distributors, Machine Tool Builders and Dealers. For complete information, contact a Skinner Representative or write us at Dept. 184.

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- New Plant Outlays Steady
- MAPI Pamphlet Justifies Tax Cut
- "Utility Type" Price Controls Proposed

Keeping up with Washington

Loring F. Overman

Outlays for new plant and equipment this year will rise approximately 4 per cent above 1958—to 31.8 billion from 30.5 billion dollars—according to a survey of capital-spending intentions completed by the Commerce Department and Securities and Exchange Commission.

While forecasting no boom, the study suggests that business may anticipate a steady, uneventful year, with the last two quarters just about holding their own. There is even a possibility, say Commerce Department and SEC analysts, for some slight improvement over the indicated trend.

Reason is that the survey questionnaires, completed by businessmen in January and February, may have been a bit on the conservative side. Excess of capacity over demand appears to be keeping the lid on plans for additional manufacturing facilities, temporary at least, but with consumer optimism rising, an upturn is not regarded as impossible.

Forecast for 1960 is that the upsweep will have caught on, permitting thhe conclusion that plant-equipment outlays may gain 6 to 7 per cent over this year.

MAPI Pamphlet Justifies Tax Cut

Machinery and Allied Products Institute is continuing to urge the business community to inform senators and congressmen of the economic necessity for reduction of corporate income tax rates.

Latest MAPI effort is a new pamphlet, "Effect of the Corporate Income Tax on Investment," available at $1 per copy from the Institute, 12 Eighteenth St., N. W., Washington 6, D. C.

In suggesting that businessmen use the pamphlet as a basis foŕ urging members of Congress to reduce the present high 52 per cent rate, MAPI observes:

"The rate is in fact at a critical level. Analysis shows that the retarding effect of the tax on corporate investment rises abruptly beyond this level. By the same token, large gains are possible from rate reductions."

"Utility Type" Price Controls Proposed

"Utility type" price regulation of steel and other basic metals was part of a proposal included in a price-wage-rent control bill (S 1452), introduced by Senators Neuberger (D-Ore.) and Wiley (R-Wis.).

The bill would give the President authority to establish temporary price controls in the event of a declared war, or whenever reports of the Council of Economic Advisers, the Bureau of Labor Statistics, and the Federal Reserve Board indicate that inflationary pressures threaten the economic stability of the nation.

Another Heavy-Equipment Investigation

Federal hearings which will investigate imports of large steam-turbine generators may affect other imports. The investigation has been ordered by the Office of Civilian Defense Mobilization, at the request of General Electric Co. and Westinghouse Electric Corporation.

It was sparked by the Tennessee Valley Authority's award of a turbine-generator contract to a low-bidding British firm. The hearing will be conducted by authority of the national security clause of Section 8 of the Trade Imports Expansion Act of 1958. Those opposing the overseas award contend that in the event of a national emergency, servicing or repair of equipment would be difficult or impossible, thus threatening national security.

Bulletin "F" Depreciation Yardstick, Pending

As late as mid-March, the Treasury Department had not announced whether it would publish a revised version of Bulletin F, which lists the useful life spans of various assets for depreciation purposes. The revised bulletin was considered by some as providing a too-rigid yardstick for the guidance of tax men.

The current bulletin, although unchanged since 1942, serves as a sixty-seven-page guide to acceptable depreciation practice, rather than as an unbreakable set of rules. Principal objections to Bulletin F are that it does not mention scores of new type items, and that its depreciation charts are based on the mechanical life of machinery rather than on useful life as influenced by obsolescence or the development of competitive items.

DOD Authorizes New "Active Base Package"

Provision has been made for a third category of Government-owned production equipment to be included in the industrial-mobilization base maintained by the military services. A new Defense Department Directive (No. 4215.1) adds an "active base package" to the two specific categories previously authorized: "package plants" and "standby lines."

An "active base package" would consist of idle Government-owned production located in an active plant, to be used to augment existing equipment either for acceleration of production or to implement a change-over to a new or modified production item in the event of an emergency. The equipment in the package would be in place and ready to go, as distinguished from "package plants," which may be either in storage or actually on location. Both "package plant" and "standby line" consist generally of equipment intended to be actuated as a unit.

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- 1⅛" Collet Capacity Dividing Head and Cutter Spindles
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- Plain or Universal

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HARDINGE BROTHERS, INC., ELMIRA, N. Y.

OFFICES IN PRINCIPAL CITIES. **EXPORT OFFICE** 269 LAFAYETTE ST., NEW YORK 12, N. Y.

Machinery
MAY 1959

An Inch Is Now an Inch

MY EDITORIAL in March MACHINERY of last year stressed the confusion sometimes occurring in engineering circles and scientific laboratories because of the fact that three different values for the inch have existed in the inch-using countries of the world. Two different values have actually been used in the United States—25.4 millimeters and 25.4000508 millimeters.

The difference in these values amounts to less than one-hundred-thousandth of an inch, which engineers in past years believed was so infinitesimal an amount it could be ignored without causing complications. However, advances in modern industrial technology have reached the point where true interchangeability is impaired by laboratory variations as minute as one-millionth of an inch. Variations ten times that amount have, therefore, assumed an important aspect.

Confusion in the realms of ultra-accuracy resulting from inch variations will be eliminated on July first of this year. On that date one standard inch will go into effect the world over as the result of the adoption of an International yard of 0.9144 meter by the following standards laboratories in the inch-using countries: The Applied Physics Division, National Research Council of Canada; Dominion Physical Laboratory of New Zealand; National Bureau of Standards of the United States; National Physical Laboratory of the United Kingdom; National Physical Research Laboratory of South Africa; and National Standards Laboratory of Australia.

This new International Standard for the yard gives an inch standard of 25.4 millimeters—the same as that adopted by the American Standards Association in 1933 and used heretofore in Canada.

An inch is now an inch around the globe, or rather will be, on July first.

Charles O. Herb

EDITOR

a new plan to give you

INCREASED VALUE in BUYING METALS

Never before have all the values of this new plan been available to you—from Ryerson or from any other source. Outlined here are some of the principal advantages—each representing many possibilities it will pay you to explore.

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1. Ryerson inventories now at all-time high. No others anywhere even come close in size and diversity.
2. The newest steels first. Typical examples: LEDLOY® tubing, LEDLOY 375 bars, new leaded alloys.
3. Hard-to-get intermediate sizes and special analyses—plus, of course, practically all standard types and sizes.
4. High inventories are scheduled to be maintained throughout the year, *regardless* of market conditions.

VALUE ANALYSIS ADVANTAGES

1. New quality-control standards, completely detailed and published, govern every aspect of the specifications, inspection and certification of *all Ryerson products*.
2. New closer cutting tolerances assure greater accuracy than ever before available.
3. The industry's most experienced specialists—well qualified to work with you on problems of selection fabrication and "costs of possession" analysis—help you achieve optimum value in purchase *and* use of steel, aluminum, industrial plastics and metalworking machinery.

BETTER SERVICE

1. Stepped-up processing assures even faster, more dependable delivery of regular requirements.
2. Unequaled capacity to serve—a combination of expanded stocks, equipment and staff—means unequaled ability to meet the most urgent emergency needs *faster*.

MORE FOR YOUR PURCHASING DOLLAR

In addition to all the advantages listed above, you build a business relationship with a company that:

1. Is nationally recognized as the leader in its field.
2. Values your respect and patronage much too highly to sacrifice your long-term good will for any immediate gain.
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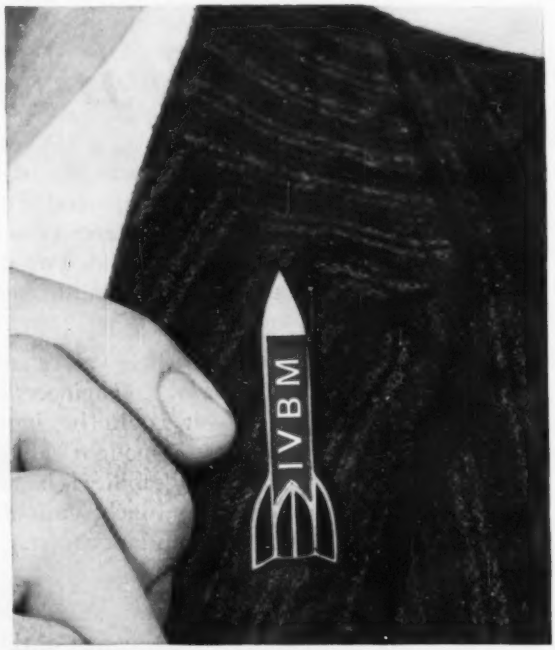

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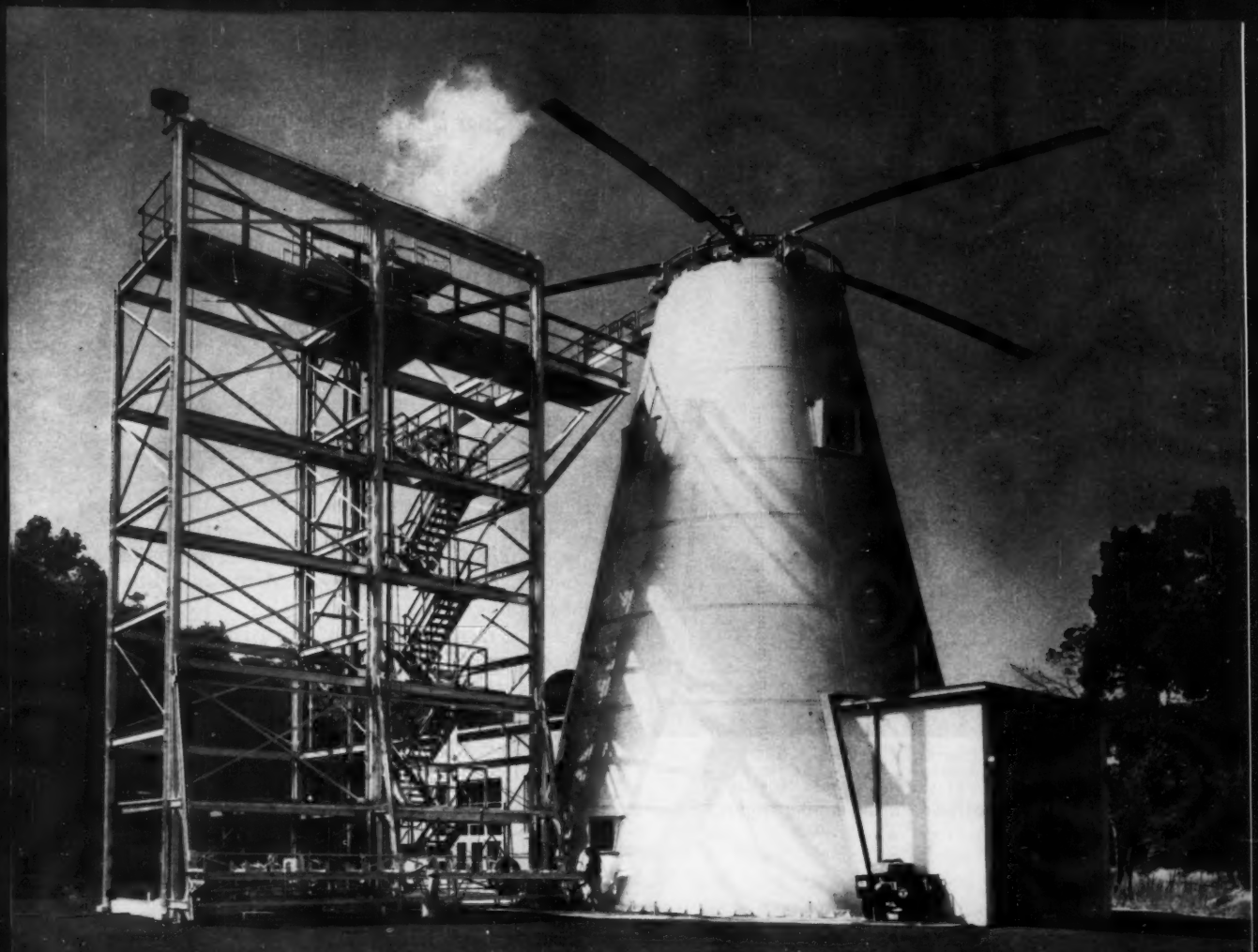

Blades for Sikorsky Helicopters

EDGAR ALTHOLZ, Associate Editor

HELICOPTER PRODUCTION is rising at a steep rate of climb as new and often extraordinary uses are uncovered for the whirlybirds. In a push-button era that challenges the effectiveness of manned fighters and bombers, the helicopter more than retains its tactical value. How else but by helicopter can a bomb-ravaged area be evacuated when highways, railroads, and airports all have been neutralized?

Heroic rescues and missions of mercy over land and sea are a daily routine for helicopters. As an airport-to-downtown means of rapid transit, many cities are finding them invaluable. Before long, giant helicopters will be lifting whole trees out of forests, installing preassembled cross-country electric transmission towers, and transporting factory-built dwellings to building sites.

The most distinguishing part of a helicopter is, of course, its main rotor blade assembly. This article describes the manufacture of the blades at the Sikorsky Aircraft plant in Stratford, Conn.

Sikorsky 'copters have from three to five blades, depending on the size of the aircraft. Originally, blades were a combination of a wood core and a metal skin.

Fig. 1. The spar shown in cross-section, as extruded (left) and after milling (right).

Spar is a Hollow Extrusion

Today, the main structure of the Sikorsky blade is a hollow aluminum extrusion, or spar. This spar forms the leading edge of the blade. Bonded to the backwall of the spar and forming the trailing edge is an airfoil composed of a series of sections, or pockets, of aluminum sheet. A forged steel cuff attached to the blade root provides the connecting link to the rotor hub. Each blade is of constant chord, but the spar tapers in wall thickness from root to tip, and in addition, has a slight twist.

The finished blade is of such precise contour and of such exacting balance that it can be interchanged with any other blade right in the field. Behind this accuracy lies a host of modern manufacturing techniques, like the use of ultrasonics to control spar-wall thickness and the metal-to-metal bonding of the pockets.

Cross-sections of the spar extrusion, 6061-T6 aluminum, are illustrated before and after processing in Fig. 1. For the big five-bladed helicopters, spars are approximately 33 feet long. Their weight of nearly 700 pounds as extruded is reduced by machining to about 225 pounds. The reason for the great difference in the mass of the two sections is that an additional amount of metal is required for a short distance at the root end to assure an efficient joint.

At the aluminum mill, the spar is given a rough twist of 3 to 6 degrees as part of the straightening operation following the post-extruding quench

Fig. 2. As the spar carriage advances, the inspector rotates the borescope to examine the entire internal surface.

In the first of two incoming inspections at the plant, a 1-inch section of material is sawed off each end and brought to a checking fixture. Dial-indicator readings are taken of wall thickness at various points on the profile. This information is recorded on a dimensional sheet which accompanies the spar. Thus, any eccentricity between the external and internal profile—caused by a shift in the mandrel in the extruding process—can be corrected by controlling the amount of metal removal from each side of the spar during the subsequent milling.

In the second incoming inspection, Fig. 2, the inside of the extrusion is examined with a borescope for blisters, tears, or other surface imperfections. The instrument consists of an eyepiece, objective tube, right-angle viewing head, several extensions, and the necessary optical and illuminating systems.

During the inspection, a motorized carriage on which the spar is supported advances toward the borescope. The inspector, peering through the eyepiece, keeps rotating the instrument so that the entire internal surface of the spar comes into view. After one-half of the spar length is inspected, the carriage is retracted, the spar is turned around, and the other half is inspected.

Spar Twist Must be Precise

The rough twist developed in the spar when extruded is now corrected. In this step, performed on the equipment seen in Fig. 3, a double-headed twister moves along the spar, which is supported in a horizontal position. Each head is equipped with a set of jaws which conform in shape to the external contour of the work.

The twister, which is rolled over a track, indexes at 1-foot intervals. At each interval, both jaw sets close tightly around the spar. Then, with one head remaining fixed, the other head rotates slightly to produce the twist. For a typical spar, end-to-end twist is 5 degrees 21 minutes.

When the mechanism has traversed and twisted the entire blade length, the work is checked with a Clinometer. This is a vernier type instrument supported against a frame which straddles and rolls along the spar. Readings are taken at each twist interval. If the amount of twist is outside a tolerance of $\pm$ 5 minutes, the section is reworked.

Milling the spars, next in order, is undoubtedly the most dramatic metal-cutting activity in the Sikorsky plant. In a separate room dominated by seven Farnham spar mills, the nose, backwall, bottom, and top of the spar are cut to contour. A close-up view of one of the machines milling the top of the spar appears in Fig. 4.

Work Floats on Nests

The work is supported on a series of nests spaced on 1-foot centers. Toe dogs at the ends prevent movement axially under the cutting thrust, but the spar floats freely on each of its nests. When the milling head feeds over the spar,

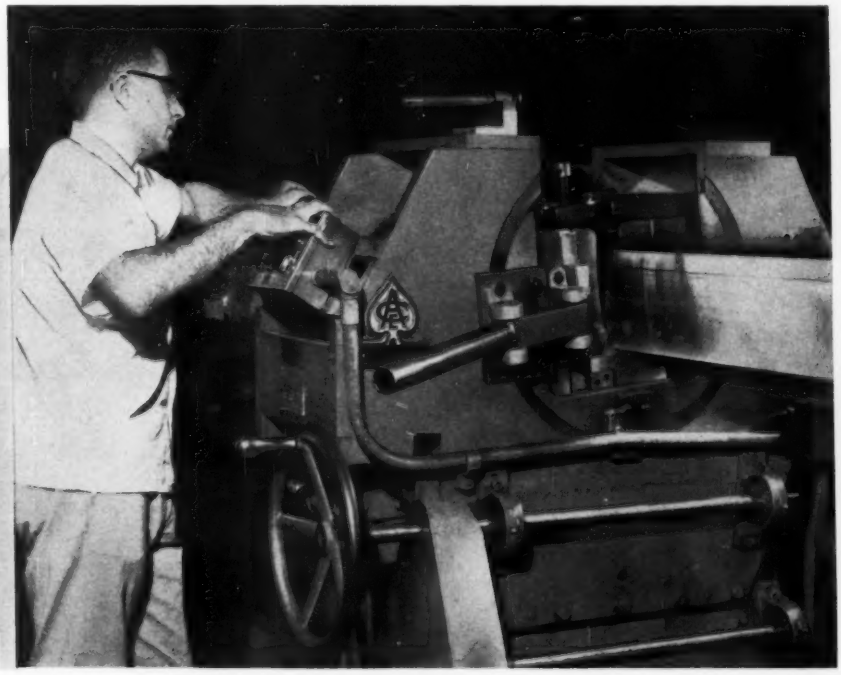

Fig. 3. Jaws in the stationary head of the twister hold the spar while the other head rotates slightly.

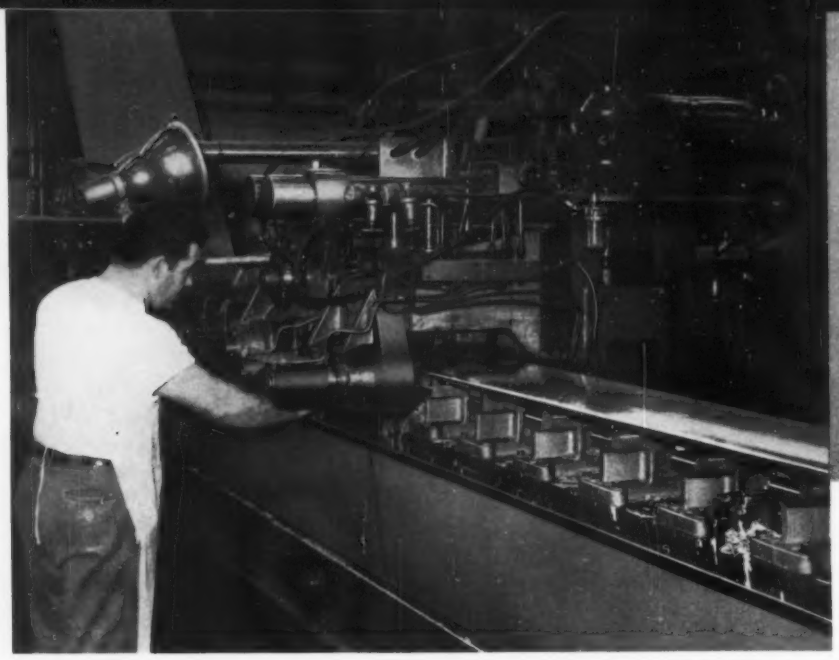

Fig. 4. Because of its twist, the spar floats on the nests and is fully seated only when it is directly beneath the milling head.

air-operated rollers in front of and behind the cutter arbor force the section of the spar which is directly beneath the head firmly against its nest. Because of the twist in the spar, it is not fully seated in any of the other nests at that particular time. Thus, during the feed of the head over the machine bed, the spar rotates slightly as it is forced by the rollers against one nest after the other.

The head, powered by a 30-hp motor, contains its own feed train which engages a herringbone rack in the bed. To develop the required root-to-tip taper in the spar wall, the head moves downward against a template as it traverses the bed. Nests on the machine which mills the bottom of the spar are all the same height, since the bottom is milled first and the other side of the extrusion is still straight. However, on the machine which subsequently mills the top of the spar, the nests are graduated in height to compensate for the taper now in the other surface.

The milling of the bottom and the top of the spar actually consists of two separate operations

Fig. 5. Wall thickness is measured ultrasonically as waves passing through the material are reflected back.

Fig. 6. A series of hand operations remove only 1 to 4 pounds of metal, but are exacting enough to require careful training of personnel.

for each. In the first, a pair of interlocking carbide-tipped cutters develop the contour. In the second, two high-speed steel cutters produce a step and groove along the spar backwall for the bonding of the airfoil pockets.

All four cutters are mounted on the same arbor, and the arbor can be indexed axially to alternate between two positions. Once the contour is completed, the arbor is indexed away from the spindle, and the step and groove are cut. In this way, no time is lost interchanging cutters and arbor spacers.

Wall Thickness Gaged Ultrasonically

All of the cuts are climb-milled with a spindle speed of 3600 rpm. Three rough cuts, performed with a slow feed, remove metal to a depth of 0.325, 0.200, and 0.075 inch, respectively. After the third cut, readings are taken of wall thickness with a Vidigage, Fig. 5.

This instrument, employing an ultrasonic principle, measures the thickness to an accuracy of ± 0.001 inch. The inspector coats the test area with a thin film of oil which serves as a coupler,

Fig. 7. Each of the pockets contains eight triangular ribs. Ribs are bonded to the pockets, and later the pockets are bonded to the spar backwall by a film adhesive applied with heat and pressure.

Fig. 8. After the rib has been cleaned and warmed, the film adhesive is laid on the edges. All excess tape is next trimmed off.

then places a piezoelectric transducer on the spar surface. Excited by an electronic-sweep oscillator, the transducer vibrates over the range of frequencies generated. Continuous ultrasonic waves pass through the material and are reflected back when they hit the inner surface of the wall.

Resonant frequency varies with the wall thickness. When the ultrasonic waves and frequency of the wall are in harmony, the current of the oscillator tube increases, and is indicated by a vertical line. Readings are taken at specified intervals along the spar. Since the spar wall tapers from root to tip, different readings are set up for each check point. Thus, the reading closest to finished wall thickness determines the depth of the finishing cut. This is then taken at a higher feed rate.

After an end-milling operation has been completed on the root to adapt it to the cuff, the spar is returned to the twisting machine for final correction. Since the spar has now been machined, the jaw sets in the twister must be changed to conform to the profile; otherwise, the procedure is the same as explained previously.

Attached to the tip of the blade is a cap piece of drawn aluminum. To receive the cap, the tip is rabbeted in a fixture with an air-driven router fitted with an end mill. The tool reaches the surface through a template in the fixture wall. While the tool is rotating, the operator moves the router around the template.

Hand-Finishing Operations Involve Many Man-Hours

Hand finishing brings the spar to exacting wall-thickness requirements. Although only 1 to 4 pounds of metal are removed (in contrast to the 475 pounds removed on the Farnham), the various steps consume the greatest percentage of man-hours per spar. As in spar milling, Vidigages are used extensively to control the thickness.

Heavy sections are first scraped, as in Fig. 6. Later, as size is approached, curved-tooth files are used. The last few thousandths of an inch are removed with portable, air-driven sanders. To receive the cuff, twelve 0.437-inch holes are drilled and reamed in the root end at this time.

Fig. 9. With all eight ribs in place within the pocket, a padding plate is placed on top and bottom, and the pocket is ready for pressure curing.

Two bed type milling machines have been converted to the job of giving the spar its final luster. The spindles of the machines carry grit-cloth build-ups. The spar is traversed back and forth, passing under an air-pressure plate which forces the bottom surface onto the rotating grit cloth. The spar is borne on motorized rolls which move over rails set up over the machine bed. The top of the spar is polished on one machine, and the bottom on the other.

All spars then are anodized to prevent corroding. The four-bath sequence consists of a cleaner, hot rinse, chromic acid, and final hot rinse. The chromic-acid bath produces an anodized layer which also provides a means of checking for any flaws in the spar material.

Spar processing is now completed.

Sikorsky Pioneers Technique of Metal-to-Metal Bonding

When the trailing-edge surface is added to it, the spar becomes a blade. As stated previously, this surface is composed of a series of aluminum-sheet pockets. A blade for a large ship will have as many as twenty-seven pockets. Like the spar, they are of 6061-T6 material. Sheet thickness increases from 0.016 inch for the pockets at the root to 0.020 inch for those at the tip. Some of the completed pockets appear in Fig. 7. The triangular cross-section of the pockets is obtained by wrapping the skin around eight ribs, also of aluminum.

Ribs are attached to the pockets, and the pockets, in turn, are attached to the backwall of the spar by metal-to-metal bonding. Sikorsky has been one of the pioneers in the technique, which employs a structural film adhesive.

In the bonding room, a temperature of approximately 72 degrees F. is maintained at all times. Faying surfaces are cleaned first with a commercial metal conditioner and then with alcohol. The ribs are warmed on a hot plate, then supported on a filler block while the tape is laid on, as in Fig. 8. The adhesive used is 0.006 inch thick. (Other tapes used are 0.003 and 0.010 inch thick.)

Fixtures Hold Ribs in Place During Pressure Curing

After the excess tape has been trimmed off, eight of the ribs are inserted in each of the pockets. The assembly is made in a fixture, Fig. 9. In the illustration, a padding plate having rubber strips is being placed on top of the pocket. (Another padding plate has already been placed beneath the other side of the pocket.)

Clamps are then tightened over the top plate, and the fixture is closed tight in a small press. The final step is to cure the bond. This is done by placing the fixtures in an oven. A temperature of 320 to 350 degrees F. is held for thirty to

Fig. 10. Technician, at blade tip, observes unbalance through magnifying glass in front of the scale in foreground, then adds appropriate weights to inside of tip pocket.

sixty minutes. Destructive tests of the bond show that the metal will tear before the bond itself will fail.

In bonding the pockets to the spar, the adhesive is laid on the step milled along the backwall. Pockets are clamped in position and the bonding area is cured by strip-heating units, it being impractical to place a long member like a spar in an oven. To contain the heat, blankets are placed over the spar during the curing cycle.

Blades Balanced Within 6 Inch-Pounds

After a cuff has been bolted to the root end, the blade is painted and then goes through a static balancing (Fig. 10). With the cuff pinned to a fulcrum which corresponds to the position of the helicopter rotor hub, the blade is balanced to counterweights of known value. A technician stands at the blade tip, observing the unbalance on the scale in the foreground. Small weights are added at the tip, if necessary, to balance the blade within 6 inch-pounds. The series of covers, seen in a raised position, are lowered over the blade during the actual balancing. They serve to exclude any drafts of air which might affect the balance.

In subsequent dynamic and aerodynamic balancing steps, two production blades are put on a hub with a master blade and run at operating speed. The weights added in the static balancing are moved chordwise, if necessary, to change the pitch moment. Also, tabs on the production blades are bent up or down to increase or decrease the moment to match the master. This step assures blade interchangeability in the field.

After assembly to the main rotor head, blade performance is checked on the cone-shaped whirl test seen in the heading illustration. To the left of the stand is the elevator used to lift the blades and rotor to position. A closed-circuit television camera mounted on the elevator frame provides an actual picture in the control room located inside the base of the stand of the blades and rotor in operation, seen in Fig. 11. Various instruments gage and record all aspects of the performance.

Fig. 11. Inside the test stand, blade and rotor performance is observed on closed-circuit television. (Camera can be seen on top of stand in the heading illustration.)

Hard-Surfacing Shaker Screens for Uranium Mines

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IN CONSTRUCTING shaker screens that are used around uranium mines and quarries for separating various-sized chunks of ore and rock, engineers of Hewitt-Robins, Inc., Stamford, Conn., had to make certain that the material from which the screens were made would be tougher than hard rock ores handled. Screen decks for these separators are subjected to severe wear, and for many years were made of manganese steel.

A typical separator screen deck consists of a large sheet of 1-inch-thick steel plate with a pattern of holes cut in it ranging in shape from square to rectangular, as seen in Fig. 1. The sizes of the holes vary with different screens so that each screen passes only certain-sized chunks of ore. Ribs of 1 1/2-inch-square bar stock run the length of the screen between the holes, being superimposed on the cut-out sheets. Finished screen deck plates are as large as 6 by 7 feet, and weigh up to 1500 pounds.

Wear is severe over the entire top surface of the screen. The short lengths of the baseplate between the ribs or skid bars must withstand considerable grinding action as the chunks of ore vibrate back and forth and work their way down the length of the screen. Hewitt-Robins engineers wanted screens that would stand up better than the ones already in service, yet cost no more. Mild steel hard-surfaced with a wear-resisting alloy was the answer to this problem.

The steel plate is first cut out and skid bars welded on as shown. Then the screen decks are placed under the automatic welding fixture in

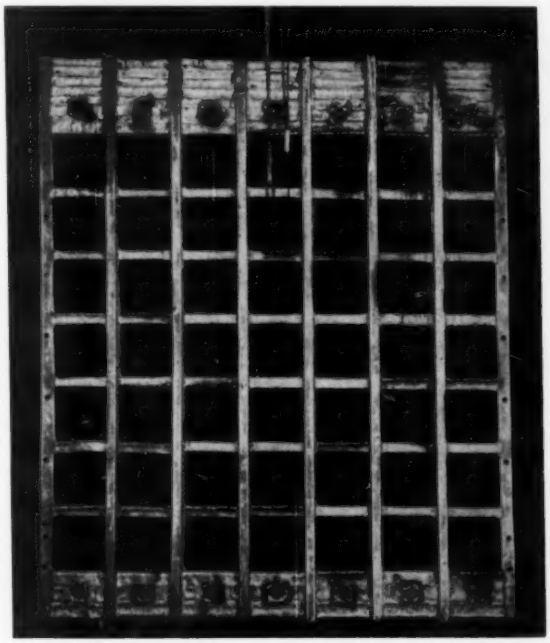


Fig. 1. Typical separator screen deck for uranium ore constructed of heavy steel plate with holes cut in it and ribs or skid bars welded on integral metal between the holes. Wearing areas are hard-surfaced to resist the abrasion of ore and rock.

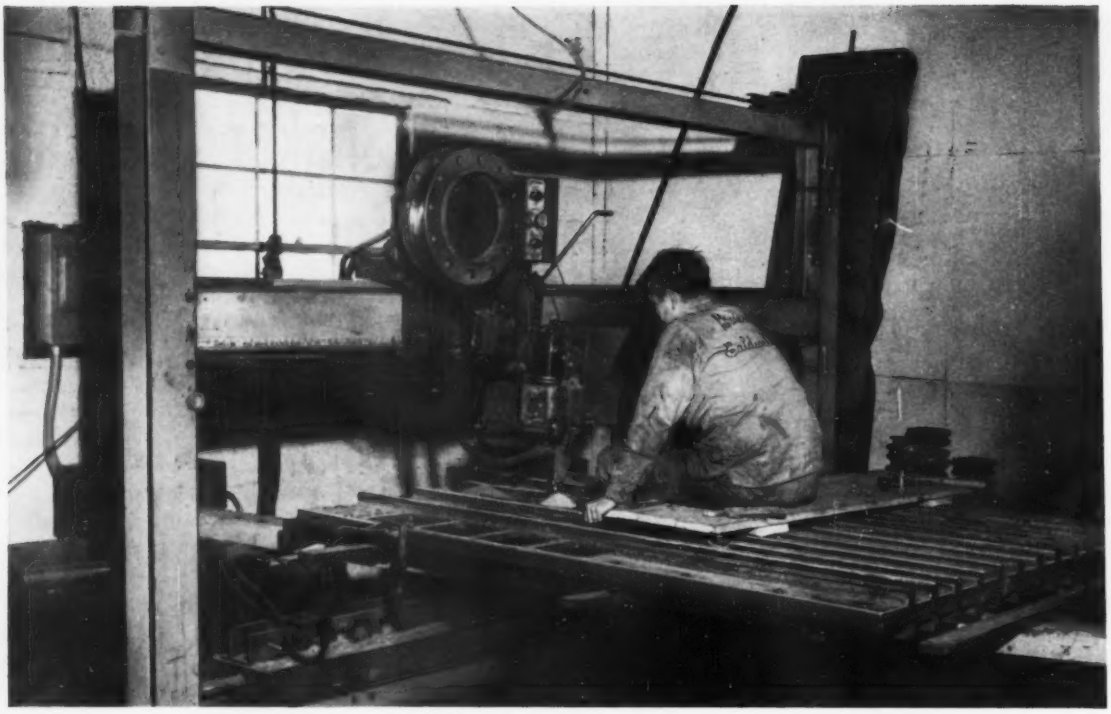


Fig. 2. Equipment for depositing the hard-surface alloy consists of a standard gantry type fixture with a carriage-mounted welding head that rides on a beam over work.

Fig. 2, which is of standard gantry type. A Lincolnweld submerged-arc welding head is mounted on a beam so that it can travel across the work. The beam can be raised or lowered with respect to the work. The welding head is equipped with a Spreadarc attachment to deposit beads up to 2 1/2 inches wide (heading illustration).

With the screen deck properly aligned under the fixture, the entire face of a strip of plate between the ribs can be hard-surfaced with one pass beneath the welding head. A small sheet-metal trough suspended from bars serves as a dam on both sides of the plate to hold the molten flux and weld metal, so that beads can be made right out to the edge of the work without spilling over.

The deposit is a medium-carbon alloy steel. It was selected as the material that would give the best combination of abrasion and impact resistance. The welding materials are 5/32-inch, mild-steel, automatic electrode (L-60) and Lincolnweld H-550 hard-surfacing flux. All the alloy in the deposit comes from the hard-surfacing flux, part of which melts with the electrode and base metal in the arc.

In laying the weld, the direct current is 425 amperes at 32 volts. Negative electrode polarity is used. The head travels over the work at 10 inches per minute and oscillates across the bead 40 times per minute. This procedure results in beads 5/16 inch thick, as seen in Fig. 3.

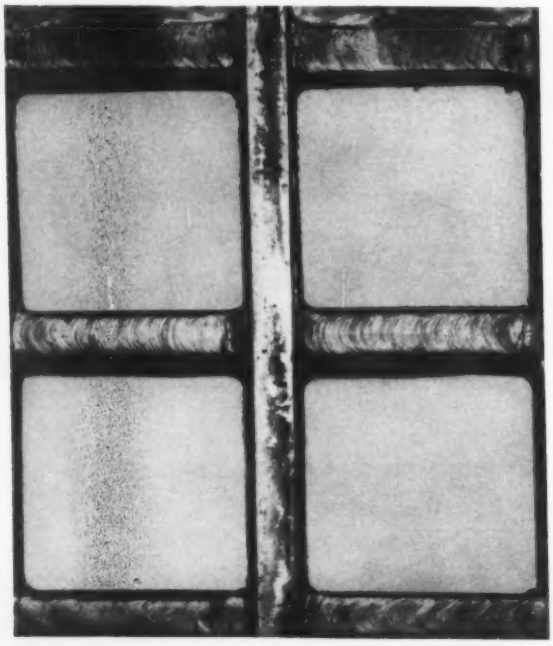
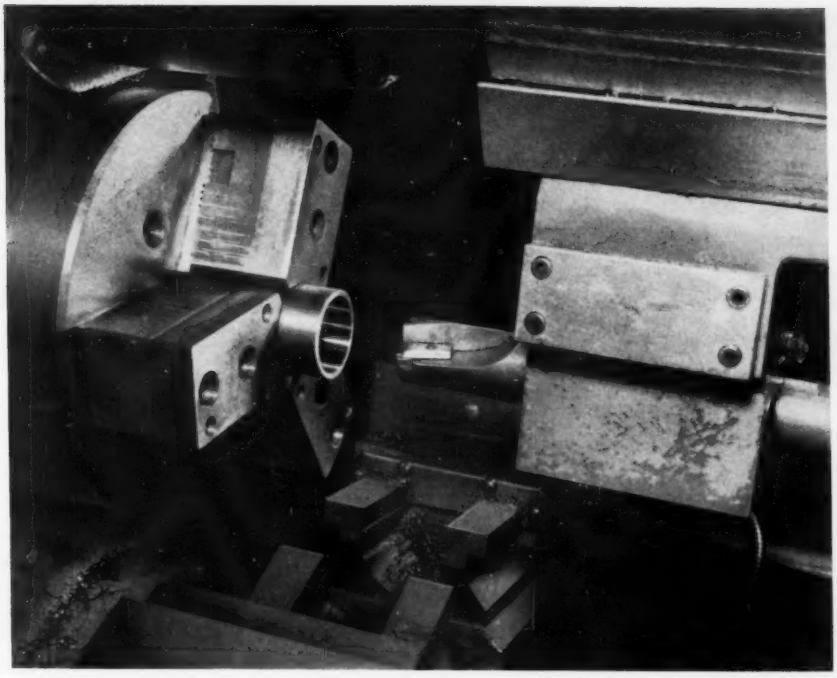


Fig. 3. Welded beads are smooth, even, and about 5/16 inch thick. The deposited material is a medium-carbon alloy steel derived from hard-surfacing flux.



COST-CUTTING WITH CERAMICS

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INTEREST in the use of cemented oxides (ceramics) as cutting agents is gaining momentum. Much experimental work is being done in the machinability laboratory of the Metallurgical Products Department, General Electric Co., to expand the future of this material.

In some areas, however, an impression has arisen that cemented oxides are valuable only when used in the higher speed or power ranges and that, to realize their full potential, they must be installed on the very latest design of machine tools. This may be so, but it is also true that many shops with less up-to-date equipment or lighter machines can obtain bonuses almost immediately from less obvious directions. Some definite advantages of this type of cutting tool are:

1. Decreased floor-to-floor time, or decreased cycle time, meaning increased production.

2. Longer tool life per cutting edge, therefore less down time for tool changes.

3. Better surface finishes and closer dimensional tolerances.

4. Reduction, or complete elimination, of grinding on hardened-steel parts.

To be presented are typical instances in shops that have earned direct benefits by adopting cemented oxide. Equipment includes most types of machine tools—standard engine, turret, tracer, and toolroom lathes; boring and milling machines; and special single-purpose machines. None of these machines were new, and several of them were more than twenty years old. Materials successfully machined range from cast iron and pearlitic malleable iron through the entire range of magnetic steels, from low-carbon seamless tubing to alloy tool steels of 130 Brinell to 760 Brinell (66 Rockwell C).

The Reeves Pulley Co. of Columbus, Ind., manufactures large numbers of discs. These are high-strength castings of pearlitic malleable iron having a hardness of 190 Brinell and requiring

Fig. 1. (Right) Surface finish in the bores of two small steel cylinders are compared. The right-hand tube was bored with a cemented-oxide insert at 679 fpm; a carbide insert was used on the left-hand tube at 399 fpm.

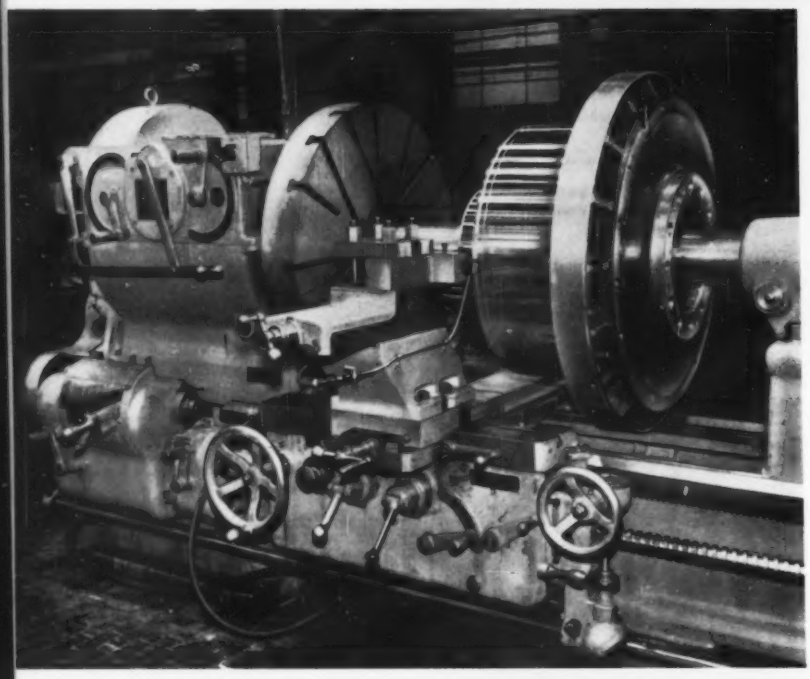


Fig. 2. (Left) Ceramic tooling is being used successfully on this recently overhauled, twenty-eight-year-old lathe. An air tube is positioned below the tool-holder to break the soft, stringy chips.

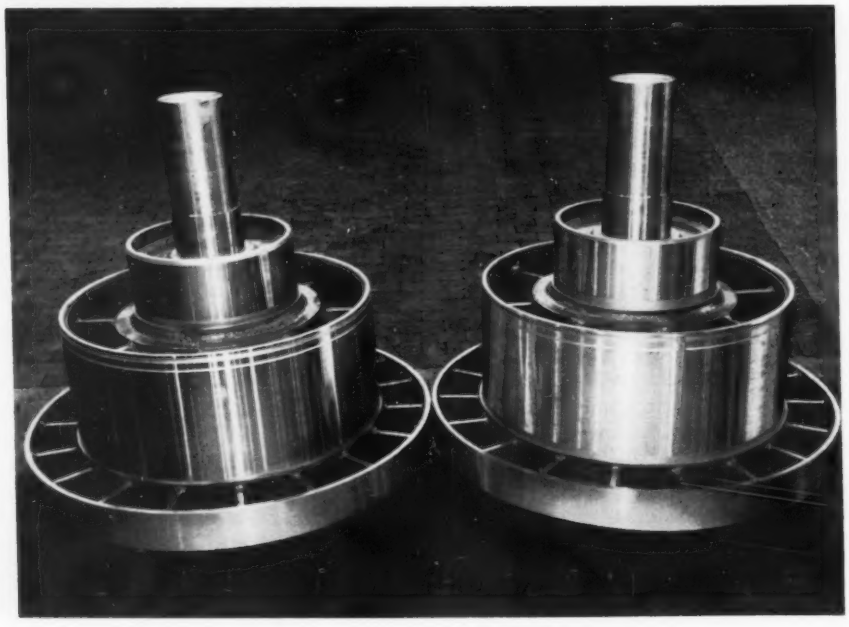


Fig. 3. (Right) Ground, right-hand armature spider runs up to 0.003 inch out of round. Left-hand spider, machined with a cemented-oxide tool, is only 0.001 inch out of round. Actually, the ground part has the smoother finish.

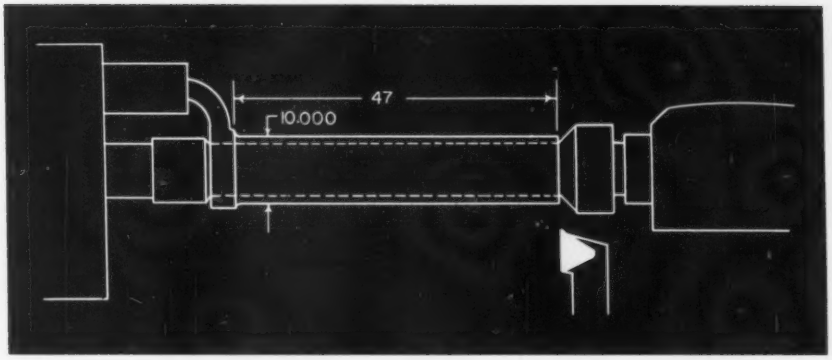


Fig. 4. Landing-gear cylinder is turned from hardened steel tube prior to grinding. Using ceramic tools, a difference of only 0.0003 to 0.0005 inch was found along entire length, and operation was completed 40 to 50 per cent faster than with previous tooling.

a surface finish of 37 to 50 micro-inches on the contact face. Original plans called for face-grinding, until experiments suggested that turning might be feasible.

Carbides are used for roughing and semifinishing on a Warner & Swasey turret lathe. Indexing of the toolpost turret then positions a tool-holder and grade 0-30 cemented-oxide insert for the final facing cut. The face is tapered from its outside diameter of 10 inches in to a diameter of 2 3/8 inches at an average speed of 249 rpm which, depending on the area being machined, runs from 625 to 146 fpm (feet per minute). At 0.020-inch depth of cut and 0.005-inch feed per revolution, 200 disc faces are finish-machined by each cutting edge.

In a Ferndale, Mich., shop—the J. L. Alexander Co.—large numbers of small cylindrical parts are being machined from low-carbon, seamless steel tubing (120 to 140 Brinell). Bore dimensions at both ends are 1.778 inches plus or minus 0.001 inch in diameter by 1 3/32 inches deep.

Two Warner & Swasey single-spindle, automatic chucking machines were set up with boring bars made in the company toolroom, but using standard insert seats and clamps. The first machining operations were run at 862 rpm (399 fpm). Depth of cut was 0.025 inch and feed per revolution was 0.005 inch. The guards required to contain the coolant affected cycle time.

It appeared that if cemented-oxide tools were used, the job might be run dry. Disposable cemented-oxide inserts were then installed (heading illustration) and, with the same depth of cut and feed rate, were run at a higher speed—1460 rpm (679 fpm). Advantages were immediately apparent, starting with surface finish. That produced by the first tooling setup had been 120 to 150 micro-inches, while with the cemented oxide it was improved to 40 to 50 micro-inches. Parts machined by the two methods are compared in Fig. 1.

There also was a decrease in tool-changing time and a complete elimination of tool grinding when inserts replaced the brazed tooling. Tool life was improved and tube production was in-

Turning Tests on Hardened Steel Cylinders* — Carbide vs. Cemented-Oxide Tooling

	Carbide	0-30 Cemented Oxide	
Speed, rpm	73	175	208
Speed, fpm	191	464	544
Feed per Revolution, Inch	0.016	0.0115	
Depth of Cut, Inch	1/8 to 3/16		
Turning Time per Cut, Minutes	40	23 1/2	19 1/2
Insert Used	TB123P4	TBT1123P4	
Reduction in Turning Time, Per Cent		41	51

*Cylinders are 10 inches in diameter and 47 inches long. They are of SAE 6407 steel hardened to 52 Rockwell C.

creased—the elimination of coolant guards resulting in faster cycle time. Previous cutting time of 0.25 minute dropped to 0.15 minute.

It has been indicated in the past that turning can sometimes be substituted for grinding. In one large job shop, rotor spiders for electric motors had been finished in a 60-inch lathe on which a large, portable toolpost grinder had been installed. Close control of size and finish were essential on these low-carbon, stress-relieved steel weldments. Although past experience with the lathe-grinding setup proved reasonably successful, a better and cheaper method was sought.

Ceramic tooling was installed on a recently overhauled 48-inch American lathe (1931) which had the necessary speed range. A heavy-duty tool-block was made for a Carboloy TFTR-85 tool-holder using grade 0-30 inserts. Overhang was kept to a minimum for greatest possible rigidity (Fig. 2). Feed per revolution was maintained at 0.009 inch, while depth of cut varied from 0.012 to 0.015 inch. The 15.500-inch diameter was run at 260 rpm (1050 fpm) and the 29.440- and 29.520-inch diameters were run at 145 rpm (1100 fpm).

Results were gratifying. Eccentricity with the lathe-grinding setup had been 0.002 to 0.003 inch, but was reduced to less than 0.001 inch with the ceramic tool. Finishing time by grinding had been 21.1 minutes—by turning, 9.9 minutes. For turning, however, an air tube was positioned directly below the tool-holder (Fig. 2). The air blast is necessary since chips from the soft, stringy weldment do not curl or break off. If allowed to take care of themselves, the chips would tend to scuff against, and mar, the finished surface.

A phenomenon peculiar to turning with cemented oxide can be seen in Fig. 3, where two rotor spiders are compared. The ground right-hand spider does not look as smooth as the turned left-hand spider. But appearances are deceiving. Actually, the ground spider is slightly smoother, has a slightly better finish than the turned spider. This illusion is caused by the extremely regular points of contact of the ceramic tool with the work-piece. Light is reflected from these points in a regular pattern, giving the impression of great smoothness.

Machining hardened metals is an interesting field for the use of cemented oxides. Turning (prior to grinding) of the landing-gear cylinder shown in Fig. 4 is a typical application. The part is SAE 6407 steel that has been heat-treated to 52 Rockwell C, and is handled on a 25-hp, 32-inch Lodge & Shipley lathe. The accompanying table has been prepared to present a comparison between setups using carbide and cemented-oxide tools. With the latter tooling, a difference of only 0.0003 to 0.0005 inch was found along the 47-inch length of each cylinder.

Although turning may, in some instances, eliminate grinding, there are bound to be areas where grinding is still essential to produce an extremely fine finish. In many of these cases, turning with cemented oxides can reduce the

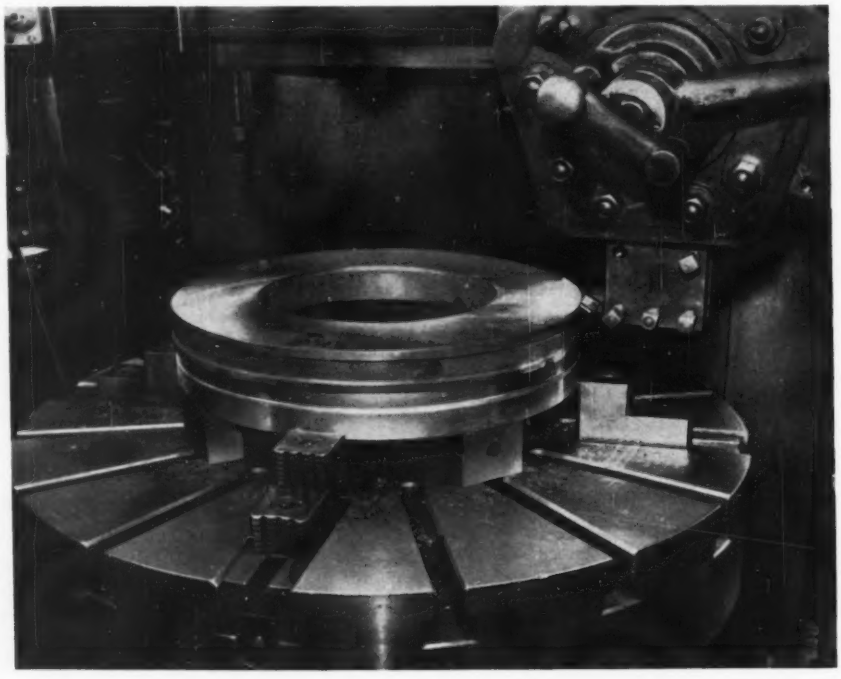


Fig. 5. Turning the periphery of a hardened commutator pressing ring on a vertical turret lathe. Previously ground all over, the ring is now turned to size on the outside and rough-turned, then ground, on the inside in less than half the time.

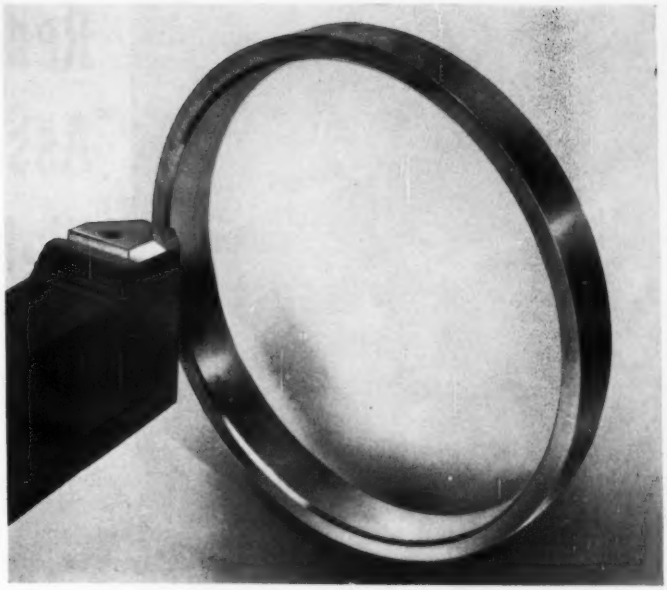


Fig. 6. High-volume, automotive bearing retainer with the tool-holder positioned in relation to the chamfer it cuts. The hardened steel rings are chamfered on a precision boring machine at a speed of 600 fpm using disposable cemented-oxide inserts.

amount of grinding previously scheduled. A manufacturer of large electrical apparatus cut grinding time on commutator pressing rings more than 50 per cent by the preliminary use of ceramic tools.

The rings, carburized and hardened to 60 Rockwell C, had been ground on all diameters until re-engineered for turning on a 42-inch King vertical turret lathe. They are now set up for finish-turning the 23.245-inch outside diameter, Fig. 5, and for rough-boring the 13.185-inch diameter tapered bore. The bore diameter is held undersize at 13.180 inches to allow for finish-grinding. This last operation is necessary because the 42-inch vertical turret lathe has a minimum feed rate of only 0.0105 ipr (inch per revolution).

For turning, a TDTR-85 tool-holder and a TB-163P3 cemented-oxide insert were used at a speed of 23.1 rpm and at the lowest available feed of 0.0105 ipr. One pass was made at a cut depth ranging from 0.013 to 0.018 inch.

A TDTL-85 tool-holder, mounting the same insert as for turning, was used for the boring operation. This was done at a speed of 18.7 rpm and at the same minimum feed rate as before. Two passes were taken—the first, or roughing, at a cut depth of 0.015 inch, and the second, or semifinishing, at a depth of 0.0025 inch. Total time for turning, boring, and finish-grinding is now 120 minutes, as compared to the 330 minutes previously required to finish all diameters by grinding only.

An SAE 5060 bearing retainer, Fig. 6, is in high-volume production in a large automobile plant. A 0.078-inch by 45-degree chamfer is required on the inner diameter of these hardened (60 to 62 Rockwell C) steel parts. It is cut on a double-spindle precision boring machine tooled with disposable cemented-oxide inserts and operated at a speed of 600 fpm with a feed of 0.005 ipr. The tool-holder (SETN-85) has a 1- by 1 1/4-inch shank and a 45-degree lead angle. An average of seventy parts is machined per cutting edge of the insert.

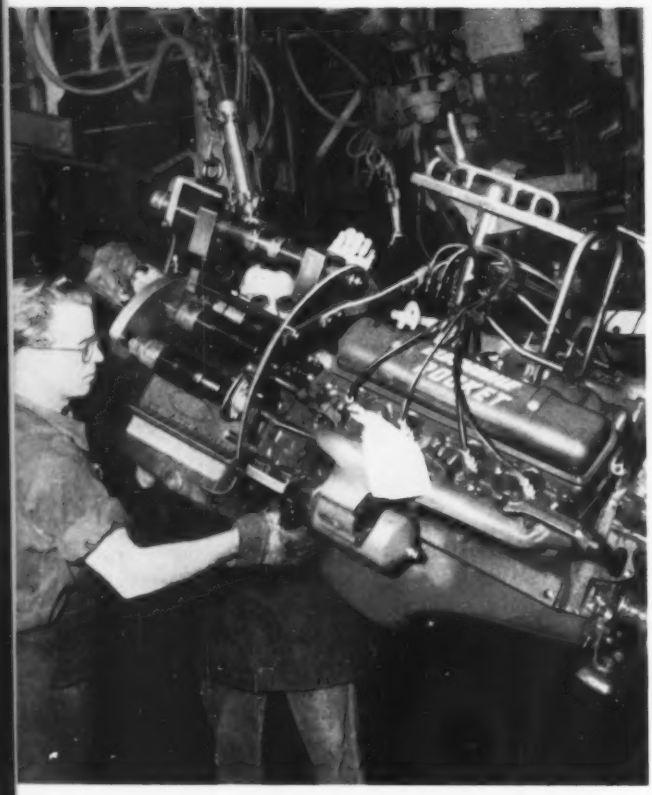
In view of the successful applications presented, it should be pointed out that cemented oxides have definite limitations such as brittleness and inability to successfully handle interrupted cuts. Cemented-oxide tools do, however, have many definite advantages, and these should be more fully explored.

° ° °

Textured Finish for Stainless Steel

A new finish, called "Fro-Zon," is now applied to stainless steel to give the metal a frosted appearance. Developed by Stamping Service, Inc., of Detroit, Mich., this finish is being used on stainless-steel automobile trim sections supplied by Allegheny Ludlum Steel Corporation.

Fro-Zon is produced by a type of semi-blasting technique that forms tiny mounds on the surface of the metal. The finish, which is put on very lightly, does not penetrate the surface, but diffuses the light rays to give a frosted effect. Also, it is applied after the steel is formed. During accelerated field tests, weathering has not proved detrimental.



Reduce Assembly Costs on High-Production Runs

When fastenings occur in a group of two or more, there is a definite advantage to assembling the entire group simultaneously.

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MANUFACTURERS of assembled metal products can look to the automotive industry for advanced ideas if they wish to mechanize production and cut time and costs by applying grouped fastenings in a single operation. Automatic machines are now being used by automotive manufacturers for the assembly of engines, transmissions, rear axles, and differentials, in addition to many other units on cars, trucks, and buses. The process can be used in other fields of manufacturing such as the assembly of aircraft engines, machine tools, valves, pumps and compressors, and home appliances.

Automatic assembly machines are relatively new to the family of multiple-spindle equipment. Nevertheless, they are a logical sequence to multiple drilling, tapping, and reaming, and offer speed, accuracy, and consistent savings. Since these machines are custom-designed for each specific job, they can be built for manual, semi-automatic, or fully automatic operation, and to drive almost any size or pattern of bolts or screws. Whether the fastening cycle is manually or automatically initiated, the assembly machines will run each fastening to its predetermined torque with excellent control of uniformity. Installed units are operating with pre-set torques of up to 580 foot-pounds.

Although almost any bolt pattern can be handled, the most popular are circular, rectangular, and in-line. Some units are adjustable to handle more than one bolt pattern and have proved to be practical when the required adjustment is not over too wide a range. Other units are designed to operate in a reverse direction to remove grouped fastenings simultaneously.

Design and Application

Design possibilities for automatic assembly equipment are almost limitless. Specifications of a few typical installations show their wide range of applications. The units need not be in the form of a fixed installation—portable units such as that shown in the heading illustration are used on a large scale.

Here, an automatic transmission is being mounted on a V-8 engine. The assembly unit is designed to support the transmission while it is positioned with the aid of the pneumatic cylinder seen directly above. Four air-motors, arranged in a semicircle, drive the fasteners home.

In a large automotive-transmission plant, two operators, each with a single-spindle pneumatic screwdriver, tightened four slotted-head screws on a rear pump to a torque of 14 to 16 foot-

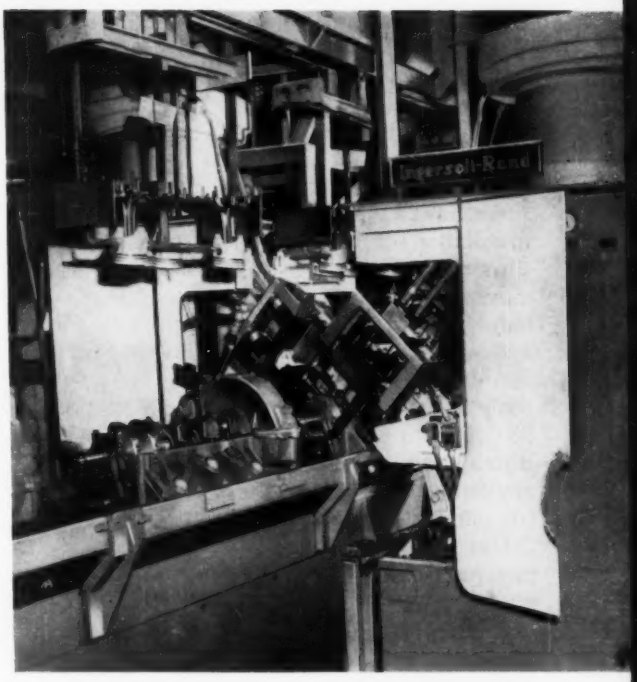
pounds. Two additional operators checked these values with hand torque wrenches. The fasteners are made of a special-alloy steel and are evenly spaced around a 4-inch bolt circle. Individual screwdrivers left burrs on the heads and not only broke an average of ten bits a day, but also stripped the threads on an average of twelve holes in the same period of time.

An automatic assembly machine was designed for the job. It is stand-mounted, air-cylinder activated, and has a clamping jig to accurately locate the work. The machine tightens the screws to the required torque without marring the heads and without stripping the threads. Whereas four men were originally required, only one is now needed, yielding a saving of approximately $60 per eight-hour shift in labor costs alone.

Two opposed automatic assembly machines are shown in Fig. 1. These are fixed installations at one station of a transfer machine handling automobile engines. From a hopper above each unit, gravity-feed chutes direct a supply of nuts to eight 3/8-inch-diameter bolts extending from the caps of four connecting-rods. Only a 7-foot-pound torque is exerted by the eight air-motors while running the nuts. This is to avoid stripping the bolts should a nut be started with a crossed thread.

After a timed interval, air pressure is increased and the nuts are tightened to the proper torque value of 35 to 40 foot-pounds. Above the block can be seen a monorail conveyor carrying the remaining four piston assemblies which will be inserted at the following station. The work area of the nut-running station, with the air-motors extended, is shown more clearly in Fig. 2.

In another instance of automotive assembly, a transmission carrier was secured to a rear-axle housing by ten 3/8-inch nuts. Due to the snug fit of a pedestal on the carrier and a matching boss in the housing, a press operation was necessary. Two presses, capable of applying a 500-



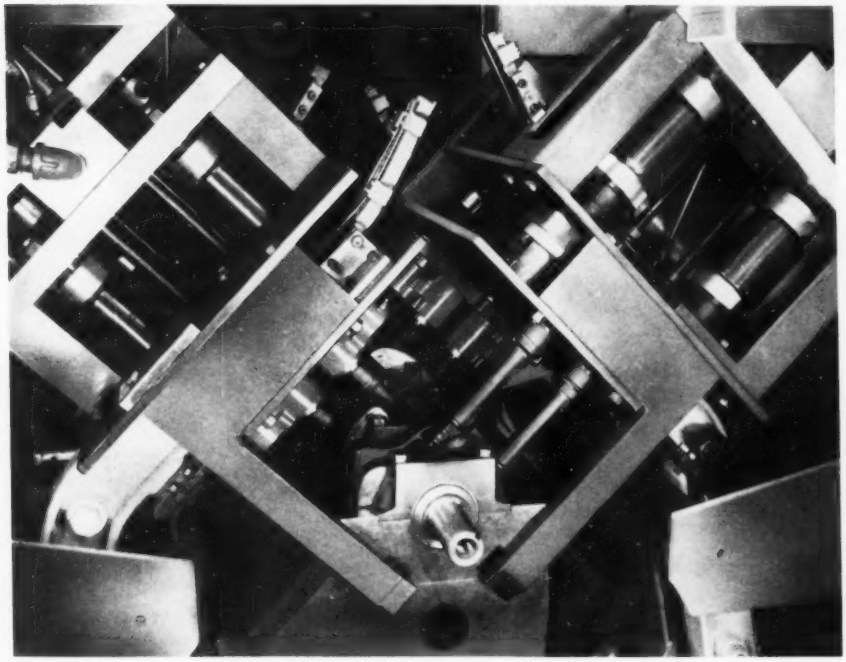


Fig. 1. (Above) A pair of opposed automatic machines for assembling automobile engines. These units feed nuts to connecting-rod bolts and run them to about 40 foot-pounds torque.

Fig. 2. (Left) Work area of the automatic assembly machines shown in Fig. 1. The air-motors are in their extended position. Four connecting-rods are handled here, and four at a subsequent station.

pound load, were used. After the carrier was pressed into the housing, the nuts were individually tightened with a single-spindle nut runner. The required 45 to 55 foot-pounds of torque was obtained satisfactorily by experienced operators, but inexperienced operators had difficulty meeting these specifications.

An advanced procedure was adopted by the installation of a 175-pound assembly machine suspended from a 200-pound balancer over the moving conveyor. The transmission carrier was hand-set on the housing and dropped to within 1/8 inch of its final location. The ten-spindle assembly machine then ran all ten nuts simultaneously to the required torque. Shop air pressure of 95 psi was regulated to 65 psi for the machine. Running all the nuts at the same time prevented any tendency to bind. Also, accurate torque control eliminated the need for a press operation.

Use of the assembly machine released three men per day for other work. The rate of 147 units per hour was easily maintained, and could have been stepped up to 250 units per hour had the production rate on the rest of the line permitted.

Illustrated in Fig. 3 is another example of how automatic assembly operations can be integrated with a moving conveyor line. The unit has a twelve-spindle power-head that handles ten cap-screws on five main bearing caps, and two of four cap-screws on the flywheel housing.

Engines are received from the powered assembly line with the engine parts, including the cap-screws, in place. A switch is actuated when the engine enters the machine, causing it to go through the following cycle:

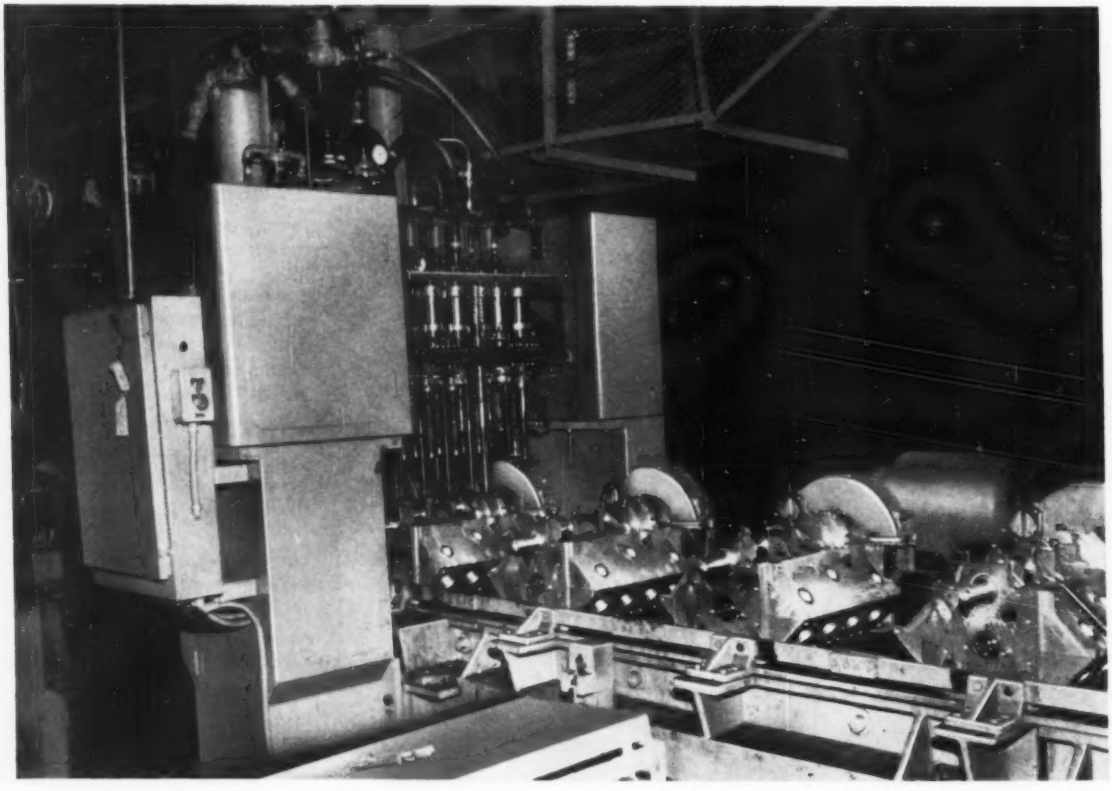
1. Air-motors driving the spindles start, and the power-head descends and engages the cap-screws.

2. All twelve fasteners are run to a stall and the air-motors shut off.

3. The power-head retracts and the engine moves out of the machine.

Torque settings for the spindles are set so that the cap-screws (1/2-inch diameter) on bearing Nos. 1, 2, 3, and 4 are tightened to a value of 90 to 120 foot-pounds, while those (9/16-inch diameter) on bearing No. 5 read 120 to 150 foot-pounds. The torque on the flywheel-housing cap-screws is not important as it must be subsequently removed for further operations.

Fig. 3. Automatic assembly machine is an integral part of conveyor line. Twelve spindles, powered by individual air-motors, tighten ten main bearing cap-screws and two flywheel-housing cap-screws. (Cover panels have been removed for clarity.)



A Machine Tool Builder Looks at NUMERICAL CONTROL

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NUMERICAL CONTROL cannot be applied to all conventional machine tools. From the builder's viewpoint, probably the most dangerous misconception is the vague idea that any machine tool, once equipped with numerical control, can become a super machine. That would be ideal, but it is not true. This is due to basic design precepts. In fact, the root of a good many problems —not heretofore recognized by either the machine tool builder or user—results from an all too common acceptance of fallacies about what numerical control is, what it does, and how it can reduce costs.

Regardless of the tolerances built into a machine tool designed for manual operation, a good operator will consciously or subconsciously feel backlash in gears, wind-up in screws, and tightness in a chucking operation. Many times the trained operator can actually better the tolerances built into the machine tool. In other words, he can compensate for the tool's peculiarities.

If the operator is removed from the conventional machine tool, an electronic or mechanical intelligence as good as the human brain should be provided. This, in 1959, cannot be done.

With regard to the question of "retrofit" (the rebuilding of an existing machine to accept numercial control), there are many problems. Bluntly stated, retrofitting is not easy. The first stumbling block may be the actual first cost. Retrofitting is bound to necessitate a complete overhauling of the machine. Quite probably, functional redesigns for adaptation to servo drive and frictionless screws are required. In addition, general rework to obtain greater accuracy may be necessary. Sometimes retrofitting works; more often, both the builder and the user are disappointed.

Why cannot a conventional machine tool be adapted for use with numerical-control equipment? To answer this question, the differences between the standard machine tool and one specifically designed for use with a numerical-control system must first be considered. The

Fig. 1. Here, a numerically controlled machine table drive, consisting of a pre-loaded ball screw and nut and thrust bearings, is being tested. Both slides move on anti-friction rollers.

numerically controlled tool is normally larger. Size, weight, width, and length of slides, and diameter of shafts and bearings are all increased due to problems not found in the design of standard tools. These problems are primarily caused by the forces of static friction, called "stiction." Stiction must be overcome to control the movement of machine slides. The importance of the static-to-kinetic friction ratio must be recognized. If the ratio is too great, or if it is erratic, the machine tool will lack close control and the accuracy obtained will be far less than that for which it was originally designed.

Machine lubrication must be foolproof and automatic. Accurate metering of the lubricant is extremely important. Under-lubrication will cause excessive wear, while over-lubrication will alter the physical ratios that affect the machine's performance.

Electric motors must be selected carefully to suit the work requirements. Underpowering, even if in the operable range, will generate excessive heat; overpowering adds unnecessary weight and extra cost. An era of design is approaching when the use of electric motors in the sizes, speed ratios, and weights presently employed in machine tools will be questionable. The use of hydraulic torque motors will also receive serious study. These can provide a wider range of speed ratios. In addition, they have little or no heat to dissipate, are flexible in application, and occupy a small space.

Designing the numerically controlled machine is only the first step. Closer tolerances are essential in building each assembly. There must be greater care in fitting screws and bearings and more careful cleaning of the slides and ways. Push and slide fits must be closer and yet allow free movement with a minimum of power. For example, drive-screws must be taut but not stretched or shortened. At the same time, they cannot be allowed to shift or have any backlash.

The mounting of main drive-screws illustrates one facet of design and assembly. In standard type machine tools, each end of these screws is normally supported in a bearing and nuts are used to take thrust. In numerically controlled machines a thrust bearing is installed at each end. This is more expensive, but necessary. In Fig. 1, the drive-screw for the table of a numerically controlled machine is seen being inspected.

After the machine is assembled, errors must be located—if there are any. The man making the final tryout of the machine must have considerable experience and theoretical knowledge to trace and correct any error. He must have both patience and common sense.

At the present time, Ex-Cell-O, along with the majority of machine tool builders, does not build numerical controls. With this arrangement, customers are given the same latitude in choosing their controls as they have had in selecting their electrical equipment; the only requirement is compatibility. Ex-Cell-O machine tools, including the Numeri-Trol profiling machine seen in the heading illustration, will accept a digital, pulse-data, or phase-analog system.

A work-piece can be defined mathematically in any of these systems in its fashion. Each operates equally well within its framework of reference and designed tolerances. In the missile industry, for example, the design engineer is usually a research physicist. He produces a mathematical definition. Until now, to reproduce this mathematical definition pictorially has been a time-consuming problem. With numerical control, however, the mathematical definition is preferred to the picture; whether the definition is analog or digital is determined by the system.

Once the machine is built and merged with proper controls, the immediate question of where the equipment should be applied is apt to arise. One of the most logical considerations is the type of product. The ones most suitable for numerical control are those that require masters, such as cams or templates, or special work-holding fix-

tures to machine. These work-pieces normally require a great deal of lead time and have a relatively low production rate.

Although parts fitting these categories are usually ideal for production on some type of numerically controlled machine tool, such equipment can be used for other jobs in industries presenting parallel problems. The products might be hundreds of templates for aircraft wing sections or parts for steam turbines where five or six units a year may be considered a large output. Each case must be decided on its own merits. Usually, however, numerically controlled equipment is used as the "master" supplying master tools to the "slaves" in the plant. These slaves are the tracer or cam-follower type machines that turn out a high volume of parts at relatively low cost.

Originally, numerical control was applied to machining operations, such as milling and drilling. Now, in the next phase of development, it is being applied to boring, turning, and grinding operations as seen in Fig. 2.

The buyer of this type of machine tool must often be trained to accept the idea of numerical control in almost the same manner and degree as the manufacturing group. To make matters more difficult for the builder, there is no rule of thumb that says this or that machine would be better controlled numerically. Nor can it be said that this product or that could invariably be improved or manufactured more cheaply. Each product must be judged by itself.

Almost every manufacturer and industry has some use for numerical control but it would be inaccurate to state that every part produced could be handled in the same fashion. It is extremely doubtful that a high-production transfer line will ever be replaced by numerical control. Some of the operations, however, on this type of line may very shortly be handled by tape or card control. Tracer type or cam-follower machines will very likely remain in use for the multiple production of low-cost parts.

Industry is ready. Numerical-control equipment is available. It remains for the machine tool builder to match the two. The field is extensive. Even in this stage of development, one of the large aircraft manufacturing companies announced that it expects to spend almost one hundred million dollars for capital equipment in the next ten years. A conservative guess is that about three-quarters of this sum would be spent in areas related to numerical control.

The applications of numerically controlled machines are increasing. Various companies are making controls that will recognize a black line on white paper—the line-follower system. A loft drawing of an automobile body can be used to make a tape that will, in turn, produce a flat template used in body work. For the average car thousands of different templates are necessary.

Today, the cost of a numerical-control unit might represent two-thirds of the entire cost of an installation. This percentage may not always remain the same. It is quite possible that future machines may become very simple basic mechanisms tied into elaborate control systems. Depending upon what is required of the equipment —and assuming that the problems of design and construction are mastered—the machine may become an appendage of the controls. When technicians have been trained to operate and service this equipment and designers educated to think of their work as a preparatory step to machining, industry will be well on its way to utilizing the immense capabilities of numerical control.

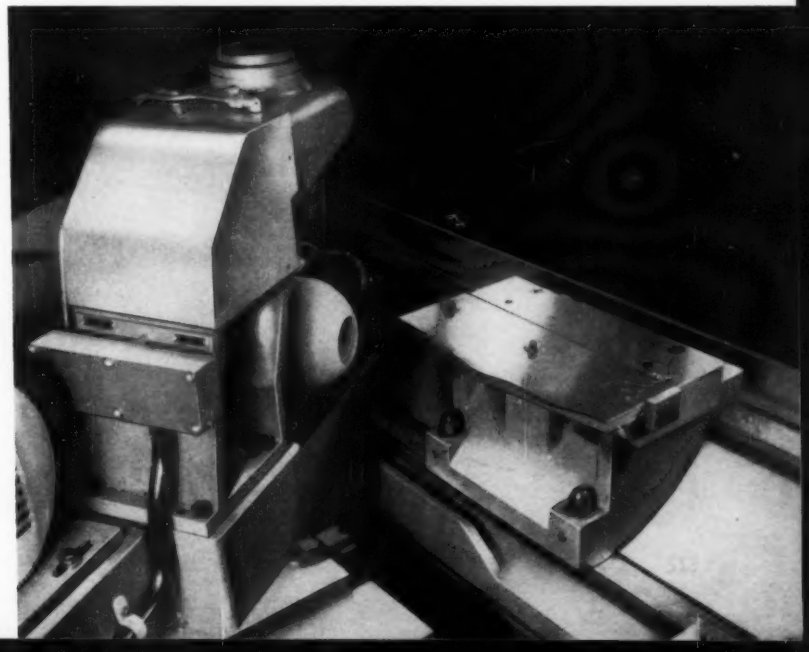

Fig. 2. A simple fixture easily adapts a numerically controlled profiling machine for grinding templates. Wheel is dressed spherically.

How Product Redesign Removed Headaches

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HOW TO SOLVE a production problem that threatens to tie up assembly lines is sometimes a poser for manufacturing and engineering personnel. For example, in early production stages the need for acceptable refueling-boom tubes for Boeing's KC-135 jet tanker-transport became urgent. First attempts to machine the 25-foot, extruded aluminum tube within an over-all tolerance of 0.030 inch resulted in a spectacular lack of success. Uneven milling cuts, twist and warp in the tube, and dimensional variations became the rule rather than the exception.

Spar-mill operators tried everything they could think of to remedy the situation, including resetting the machines for each of ten milling cuts. The rejection rate stayed at a straight 100 per cent. A detailed study was made of the boom-tube problem, from design to assembly. The extruded tubes were 25 feet long with a round inside surface and an elliptical outside surface as seen at *A* in Fig. 1. The length of the tube was not exceptional, but the weight of the extrusion exceeded the capability of the largest extrusion presses available at the time to produce within the required tolerance. Also, variation in the tube's cross-sectional thickness caused severe mandrel drift during extrusion, warp and twist during heat-treating, and difficulty in straightening by the draw-stretch method.

The tube was supposed to be straight within plus or minus 0.060 inch over the 25-foot length, while wall thicknesses were presumed to be to size within plus or minus 0.030 inch, and inside and outside diameters within plus or minus 0.005 inch. However, the extrusions exceeded engineering tolerances.

After the initial inspection, the long tubes had to be machined to produce eight flat surfaces and two curved surfaces on opposite sides as seen at *B*, Fig. 1. Several machine setups were required to compensate for twist and warp. The flat cuts varied in width, and this in turn changed the residual stresses and caused additional warp. The wall thickness varied considerably over the entire length.

So that the milling cuts would be even, a new extrusion design was recommended by Boeing engineers, as shown at *C*, Fig. 1. With this design, cutoff flats are provided on the extrusion. The number of milling cuts was reduced from ten to four. The new design also called for the use of a lighter but stronger aluminum alloy which increased the strength of the tube approximately 20 per cent. Dotted lines indicate where the four machine cuts are made. The flat surfaces end at a definite point and any variation in over-all wall thickness is reduced. The relatively thin portions of the tube are now 90 de-

Fig. 1. Cross-section of original boom tube extrusion before machining (A); cross-section of same extrusion after machining (B); and cross-section of extrusion now used (C).

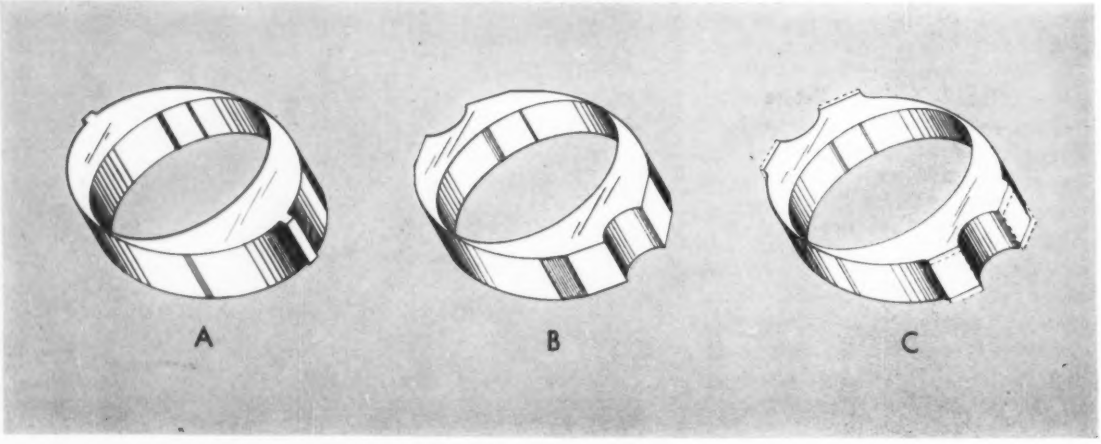


Fig. 2. Applying ultrasonic measuring equipment to check the thickness of an airplane refueling-boom tube.

grees apart, rather than 180 degrees as on the original extrusion. This design reduces the likelihood of out-of-roundness on the inside of the tube.

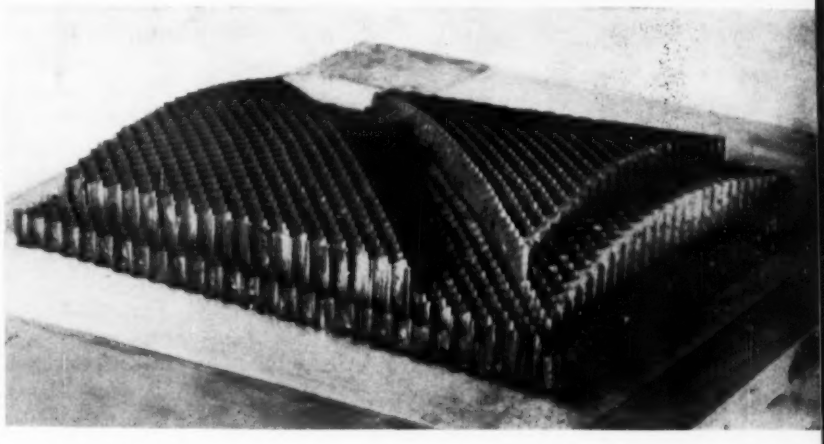
Two extrusions of the new design were milled and given a complete dimensional check. Both were accepted. They were the first two satisfactory boom tubes produced for the KC-135 jet tanker-transport. Thus, the threat of a production bottleneck was ended.

A Branson Model 14 Vidigage thickness tester based on the application of ultrasonic sound waves is used to measure the wall thickness of the tubes within 0.001 inch, as seen in Fig. 2. A complete dimensional check is made in fifteen minutes. The material thickness is indicated by a vertical line on a cathode-ray tube. A V-block fixture is used to inspect the boom tubes for straightness. The rejection rate of boom tubes is now negligible and not one has failed in flight.

Contouring Stainless-Steel Honeycomb Electrolytically

Stainless-steel honeycomb for aircraft and missile construction is difficult to machine by conventional methods. However, flat surfaces of such material are being machined successfully by the electrolytic process. At present, this process has been applied to contour machining by Ekstrom. Carlson & Co., Rockford, Ill. The company has applied for a patent covering this application of a modified tracer control and the electrolytic process to the machining of curves, spirals, and recesses in honeycomb.

Almost any shape, profile, or contour that can be machined on solid metal can now be duplicated on honeycomb as well. Close tolerances can be held, and the machined surfaces are free from burrs or metal layover. Since no heat is generated, no metallurgical changes take place, there are no grinding cracks, and the surfaces are stress-free. Also, skin brazing is simplified. A typical part that has been cut in this way is shown in the accompanying illustration.



Representative stainless-steel honeycomb part machined by the electrolytic process with modified tracer control.

Power-Brushing Deburrs and Finishes Hydraulic Pump and Motor Components

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HYDRAULIC PUMPS AND MOTORS are required to perform efficiently under severe conditions of service. Important surfaces of many close-fitting components are accurately and smoothly finished to prevent or control the flow of liquids under high pressures. Burrs or small, loosely attached, metal particles cannot be allowed to remain on any surfaces and edges exposed to the circulating fluid, only to eventually become dislodged, and render these parts inoperative. Producers of hydraulic equipment must therefore give special attention to the finishing methods they employ.

Recently, power-brush-finishing by the Brushomatic method has substantially reduced the production costs of a large variety of parts for hydraulic devices. This method, developed by the Osborn Mfg. Co., is capable of achieving finishes on surfaces and edges to a smoothness in the range of from 8 to 10 micro-inches. The degree of smoothness obtained can be controlled closely during production. In addition, the width of blend or rounding of the edges at the intersection of surfaces can be held to within a tolerance of 0.001 inch.

A non-metallic brush operating at 1750 rpm and used in conjunction with a brushing compound has been found satisfactory for finishing hydraulic pump and motor parts. The machines employed have means of regulating brush pressure, controlling the work position, and automatically applying the compound. After the start button is pushed, the work cycle is automatic.

One benefit obtained is the removal of minute, insecurely held metal particles which can cause metal-to-metal interferences between precision-machined mating parts. These particles are usually found at edges, especially where the tool leaves the work-piece after completing its cut. The flexible action of the brush allows it to constantly remain in contact with the surface and the edges being finished to remove any burrs or other surface imperfections.

Another advantage of the process is that the surface finishing and the rounding of edges or surface blending can be selectively controlled. Relatively unimportant edges need not be overfinished. A power brush can be made to approach edges from different directions to obtain different degrees of finishing. The optical comparator screen seen in Fig. 1 shows the image of a gear tooth that has been power-brushed to obtain a 0.003-inch maximum surface blend at the root. The amount of blending is reduced uniformly,

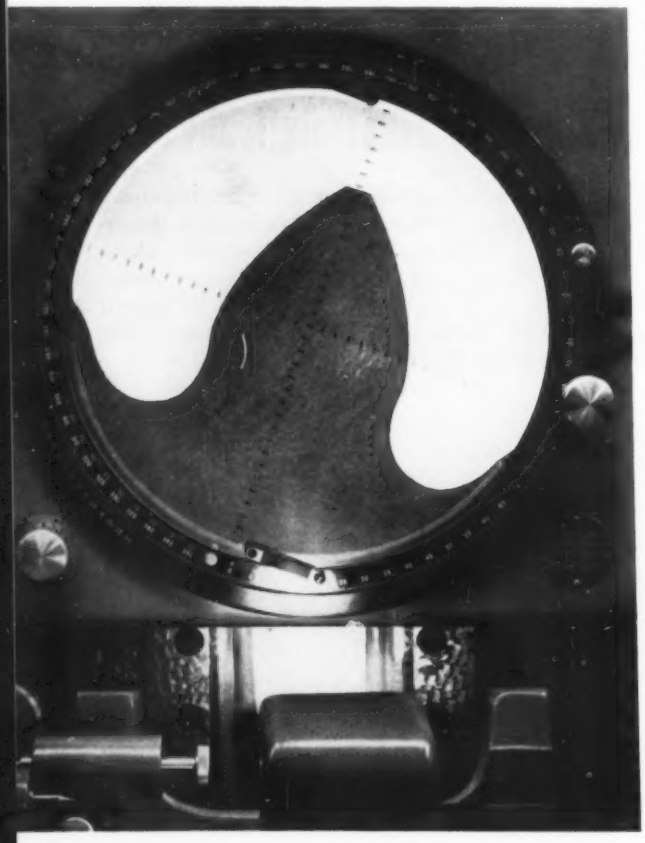


Fig. 1. Image of a gear tooth that has been power-brushed to obtain a varying amount of edge rounding or blending. Edge shape changes gradually from square at the tip to a 0.003-inch blend at root.

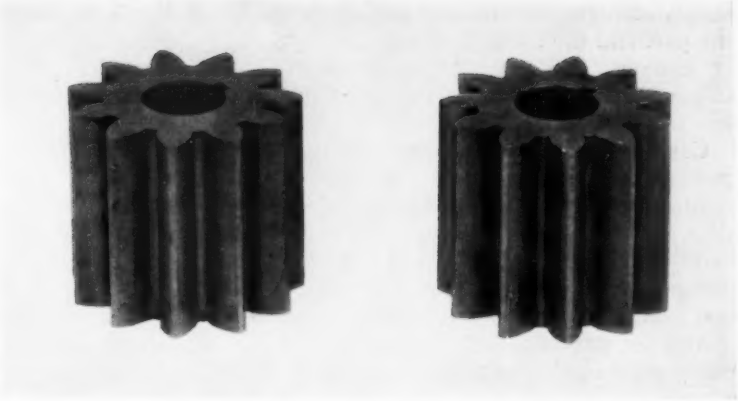


Fig. 2. (Right) Two pump gears made of powdered metal. Gear at left has a burr left by grinding while the gear at right has had this burr removed and the edges blended by power-brushing both faces for five seconds.

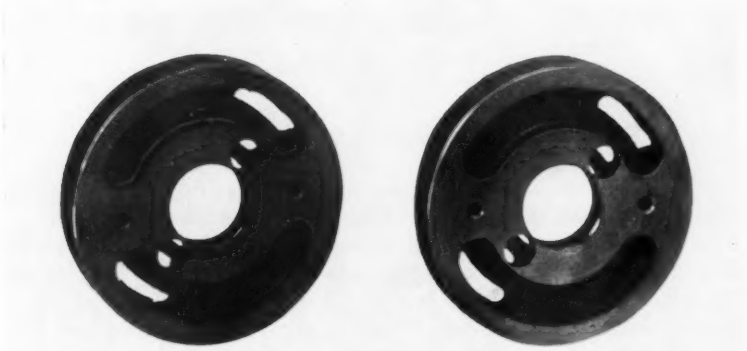


Fig. 3. (Left) Cast-iron port plates before (left) and after (right) power-brushing. Deburring and removal of cast-iron particles was important to prevent damage to other parts of the hydraulic system.

thus obtaining an unblended edge at the tip of the gear tooth.

The end faces of pump gears require a smooth surface blend generally in a size of about 0.005 by 0.005 inch for the full length of the edges around the profile of the teeth. The edges of gears can be readily blended to such tolerances on a production basis. For example, the pump gear seen at the right in Fig. 2 has been deburred and the edge finished by power-brushing each face for five seconds.

Complete mechanization of the finishing of parts which previously required several tedious hand operations has not only reduced manufacturing cost but has assured uniform results at a uniform production rate. A power-brushing machine can be changed quickly from finishing one part to another. Often this can be done by

Fig. 4. This rotor for a vane type pump, about 2 1/2 inches in diameter, was power-brush-finished on both faces and the periphery in thirty seconds. Uniform, smoothly finished edges were obtained.

simply changing the holding fixture, positioning the part and the brush to obtain the right angle of contact, and setting the brush pressure. Change-over time is frequently accomplished in less than five minutes.

Cast-iron port plates are seen in Fig. 3 before power-brushing, at the left, and after, at the right. The edges of the periphery, the circular slots, the bore, and all other holes in the right-hand plate were deburred and the intersecting surfaces blended. Since this part was made of cast iron, any loose particles had to be removed.

Another part finished by power-brushing, a pump rotor used in vane type pumps, is seen in Fig. 4. A uniform surface blend at the edges and complete burr removal have been obtained. The brushing cycle for completing both faces and the periphery was thirty seconds.

Heat-treating problems are reduced by power-brushing. Tool marks or other notch-like surface conditions can cause cracks during heat-treatment due to stress concentrations. When these surface imperfections are removed the stresses are distributed and the cracks are avoided or reduced. Power-brushing has been used to both minimize stress concentration and improve fatigue properties by reducing progressive fractures which start from minute surface markings.

Press-Fit or Slip-Fit Bushings?

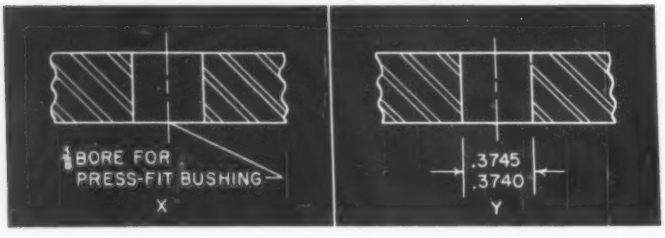
FRANK G. ZAGAR, President, Zagar, Inc., Cleveland, Ohio

The usual toolroom practice in making jigs is to jig-bore the holes for drill bushings precisely and pay notably less attention to the size of the bored hole. The bushings are then ground on their outside cylindrical surfaces to obtain a press fit in the jig. Experience in the manufacture and application of drill bushings, however, has led engineers at Zagar, Inc., to abandon this technique and adopt the use of large type slip-fit bushings.

There are several objections to the use of press-fit bushings. When a new bushing is ground to fit the hole, concentricity between the inside and outside surfaces may be lost, thus impairing the accuracy achieved by the bushing manufacturer. The stress of pressing the bushings into the jig will make the inside diameter smaller and necessitate an additional lapping operation. Furthermore, the toolmaker may improvise when lapping, since it is impractical for him to have laps for all sizes of bushings. The result is often a bushing with an incorrectly sized hole and a poor finish. If a large number of press-fit bushings are installed in a drill jig, the accumulated stress will sometimes warp the bushing plate. These conditions increase costs, interfere with accuracy, and slow up production. A press-fit bushing is specified for the hole seen at *X* in the illustration.

The disadvantages presented for press-fit bushings can be avoided by using renewable slip-fit bushings equipped with locking screws as a standard. When a slip-fit is specified for the bushings (View *Y*), no grinding is required. The original accuracy is thus retained, and the inside and outside surfaces remain concentric. Since the bushing fits the hole precisely and is a slip-fit in the bore, distortion of the bushing does not occur and the need for lapping is eliminated. Furthermore, the bushing manufacturer's finish is preserved.

Some argue that to use slip-fit bushings in holes not having steel liners will lead to hole wear in the bushing plate. Usually, however, this wear does not occur, since in practice the bushing is rarely removed throughout the life of the jig. If removal is required once or twice, replacement bushings are made to duplicate the original one in every detail. Although the operator of the jig-boring machine must not only locate the holes precisely but bore them to the exact size as well, the results more than compensate for the extra care required.



Bore in jig plate at (X) is dimensioned for a press-fit bushing. When a slip-fit bushing is used, limits are given for the hole diameter. Those shown at (Y) are typical.

TRANSFER LINE SLASHES MACHINING TIME ON SPRAY-GUN BODIES

W. J. TILLMAN, Chief Industrial Engineer
The DeVilbiss Co., Toledo, Ohio

PRODUCTION of spray-gun bodies is one of the major activities of the DeVilbiss Co., Toledo, Ohio. Five models of these gun bodies are manufactured. Each requires sixteen or more machining operations.

Until recently, all production operations except cleaning were done in sequence on conventional six-spindle drill presses and hand turret lathes. Each machine had its own storage rack. The operator took a work-piece from the rack, processed it, then placed it in the rack of the machine next in line. To avoid holding up the whole line when one machine was down for tool changing, each rack stored a large number of work-pieces.

Whenever a different model went through the lines, the machines had to be set up, and it required some six weeks to clear the lot through all the machines. Total machining time per gun body averaged twenty-eight minutes.

To expedite production and minimize labor requirements, a transfer machine, designed and built by the Swift Ohio Corporation, was installed to do the entire job virtually automatically, except for the loading and unloading.

In addition, a double-end Holomatic machine, Fig. 1, was installed to perform a qualifying operation. As a result, processing costs have dropped 47 per cent, largely because only three men are required—one man, on the Holomatic, drills and faces the trigger hole, which is used for all locating purposes in the transfer machine; a second loads and unloads the transfer machine; and a third man makes roving checks at the machining stations. Total machining time has been slashed to thirty seconds per gun body.

Bodies are either aluminum forgings or zinc die-castings. The different models have detail differences that require variations in the work-holding means, as well as in some of the tools used. Backing portions of all fixtures on the trans-

Fig. 1. This double-end machine performs the qualifying operation of drilling and facing the trigger hole. On the transfer line, the trigger hole provides a locating point for the work while in the fixture.

fer machine are identical, but for each model there is a set of pad inserts that must be placed in each fixture.

It takes a crew of three men from five to seven days to remove a set of tools and fixture inserts and to install and check another set. While this time is far less than that for the previous setups, it still is enough of a factor to make it practical to run each gun-body model in large quantities before a change-over is made.

After the qualifying operation on the Holomatic, the bodies are passed through an Acme seven-spindle buffing machine. Each work-piece makes two circuits, one for each face, with a turnover between, passing by five heads. An air-ventilated buff on which a DeVilbiss gun sprays a tripoli compound is carried by each head. In addition to giving the work-pieces a luster, the buffing assures proper nesting in the fixtures of the transfer machine.

The work stations of the transfer machine occupy two adjacent sides of a rectangle. The third and fourth sides of the rectangle are occupied by cleaning and unloading stations and by the electrical equipment, respectively. Work from the buffing operation is brought to the loading sta-

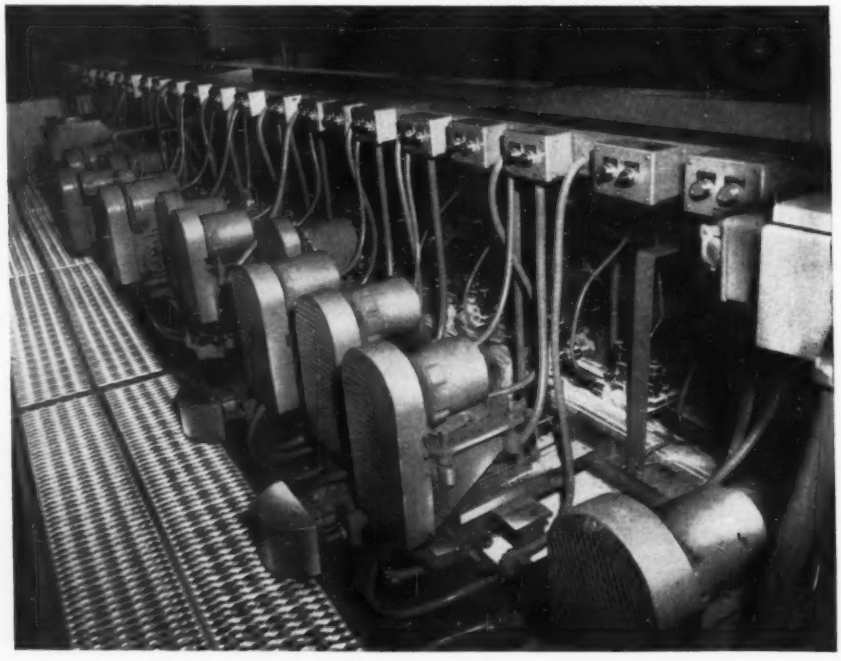


Fig. 2. Some of the fifty-two heads of the forty-three-station transfer line. Manual buttons above each head permit individual cycling for setting up. Fixtures can be seen along the path between the opposing heads.

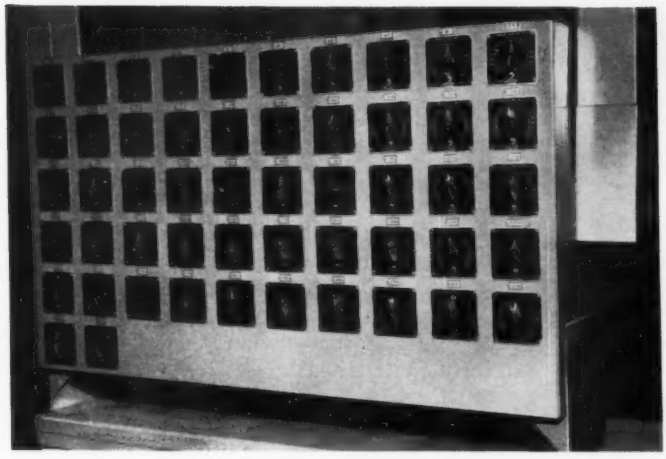


Fig. 3. Each of these impulse counters is set for a given number of cuts that a properly ground tool can make. By limiting the cuts to a safe figure, the chances of failing to produce work of specified dimensions are greatly reduced.

tion, as seen in the heading illustration. Here, empty fixtures are returned from the unloading station by the roller conveyor seen on the left. Once loaded, the fixtures are pushed over a track on to an indexing mechanism. Shot pins engage holes in the fixture bases, locating them accurately at each of the machining stations.

A close-up view of part of the line appears in Fig. 2. All tools are carried in either Bellows or Drillmation heads, each of which advances, feeds, and retracts in time with the indexing of the fixtures. Most of the heads are set horizontally, and at some stations are on both sides of the work path. Several are above the path and operate at an angle. Operations performed include drilling (some of which is step-drilling requiring more than one station), reaming, counterboring, tapping, milling, and spot-facing. On some gun bodies, external threads are cut with an acorn die which, like the taps, is fed by a lead-screw.

A feature of the machine is a panel (Fig. 3) of impulse counters. Each tool in the line has its own counter. From empirical knowledge, the counters are set for a given number of cuts that their respective tools can make and still hold size. When a tool has made this number of cuts, the counter runs out and signals a tool change. A new tool is installed, and the counter is then reset. Near each station is a locker of spare tools. In this way, the setup man always has a new or reground tool close at hand and can install it quickly.

Tools are fed at a pre-set rate by air or hydraulic means, or by a combination of the two. All stations are exactly 15 inches apart. Indexing of the work-fixtures is performed by air-operated plungers. Interlocks prevent indexing until all feed movements have been completed.

After traversing the work stations along the first side of the rectangle, the fixtures advance automatically to the adjacent side. When later they move onto the third side, they pass through a booth where chips are blown off by a mixture of compressed air and cleaning spirits. In Fig. 4, the fixtures are emerging from the booth and moving by conveyor to the unloading station.

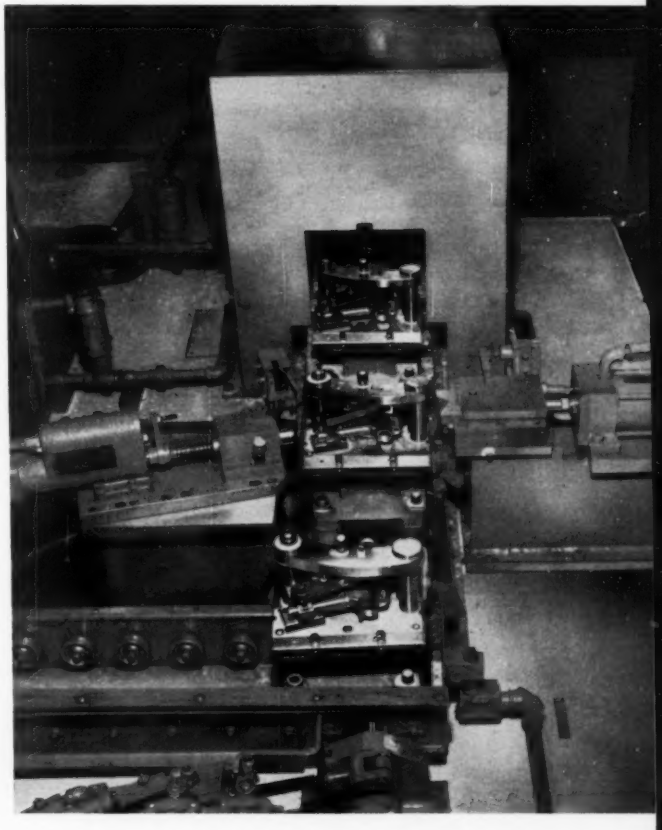


Fig. 4. On the third side of the rectangle, the fixtures pass through a cleaning booth. A roller conveyor then advances the fixtures to the unloading station.

Threading Tool Angles Solved Graphically

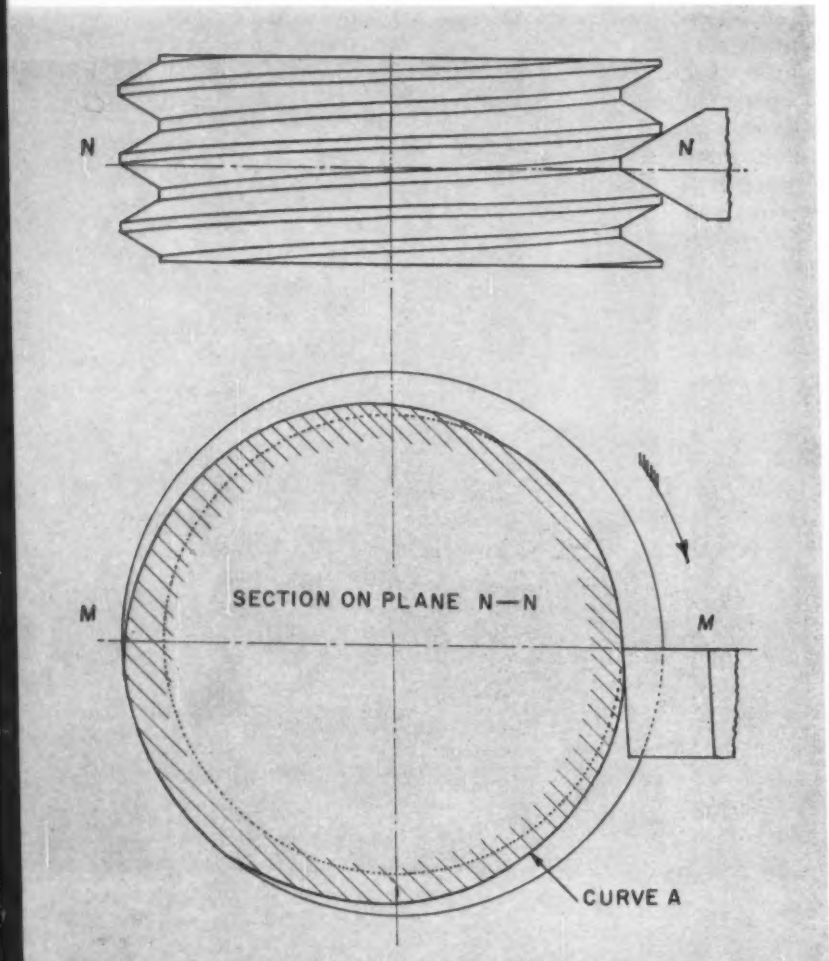
SHERWOOD C. BLISS

SOME TIME AGO the author designed a single-point, form-ground threading tool for cutting buttress threads having one flank angle of 15 degrees and an included angle of 60 degrees. This tool could be re-sharpened by simply surface grinding its top face, as this did not alter the contour of the tool tip.

A graphical solution for determining the necessary clearance angle of the tool was developed when the tool was designed. This solution is also applicable to no-lead hobs of which the axis is parallel to the axis of the work.

Fig. 1 shows two views of a 1-inch, American Standard coarse pitch thread of eight threads per inch. A single-point threading tool is shown in the cutting position. Curve *A* is the intersection of plane *N–N* and the surface of the thread helix. Any plane normal to the axis of the thread will intersect the thread helix with the same type of curve. Inasmuch as the faces of the teeth of a no-lead hob will at times assume the position of the top face of a single-point tool applied as shown in Fig. 1, it is obvious that the hob must also have radial relief on its teeth. Referring to Figs. 2, 3, and 4,

r = radius of thread at its root;
R = radius of thread at a point on curve A;
L = lead of thread in one revolution;
O = angle, in degrees, between side of thread and a plane normal to the thread axis;
w = radians;
B = w expressed in degrees;
T = tangent of thread helix angle at radius R;
x = distance from root of thread to a point on curve A;
y = length of arc subtended by angle w and radius R;
a = angle between a line tangent to curve A at its intersection with radius R, and a line normal to radius R.



Enlarged sectional views of the screw thread in Fig. 1 are shown in Fig. 2 to illustrate the method of calculating the contour of curve A. The surface of the thread helix will intersect plane *N–N* when Equation 1, which follows, is satisfied.

1. $yT = x \tan O$
2. $y = Rw$
3. $T = \dfrac{L}{2R\pi}$
4. $x = \dfrac{wL}{2\pi \tan O}$

The final equation may be expressed in degrees instead of radians as follows:

5. $x = \dfrac{BL}{360 \tan O}$

Fig. 1. Position of single-point tool when cutting screw thread and curve formed by intersection of plane (N-N) and helix surface of thread.

It will be noted from this equation that the increment in distance x for each degree of angle is a constant. Consequently, the intersection of plane N–N, or any other plane normal to the thread axis, with the surface of the thread helix is an Archimedean spiral.

Further consideration will show that the angle between curve A, at its intersection with a radius R, and a line which is normal to the radius at the intersection, becomes greater as the radius becomes less. This angle is greatest at root r of the screw thread.

Fig. 3 illustrates the method of calculating the angle between curve A, at its intersection with a radius, and a line which is normal to the radius at the intersection. Referring to Fig. 3, as angle w becomes smaller and smaller, Equation 6 becomes true:

6. $y \tan a \tan O = yT$

Equation 6 reduces to:

7. $$\tan a = \frac{T}{\tan O}$$

Combining Equations 3 and 7 we have:

8. $$\tan a = \frac{L}{2R\pi \tan O}$$

At the root of the thread

9. $$\tan a = \frac{L}{2r\pi \tan O}$$

From Equation 9 we find that angle a at the root of a 1-inch American Standard coarse thread of eight threads per inch is 4 degrees, 39 minutes. Referring again to Fig. 1, it should be apparent that no part of the periphery of a hob whose axis is on the line M–M should encroach on curve A.

Angle a at the root of a 1-inch American Standard general-purpose Acme screw thread of five threads per inch is 17 degrees, 31 minutes. The tool clearance angle should be greater than angle a as calculated from Equation 9.

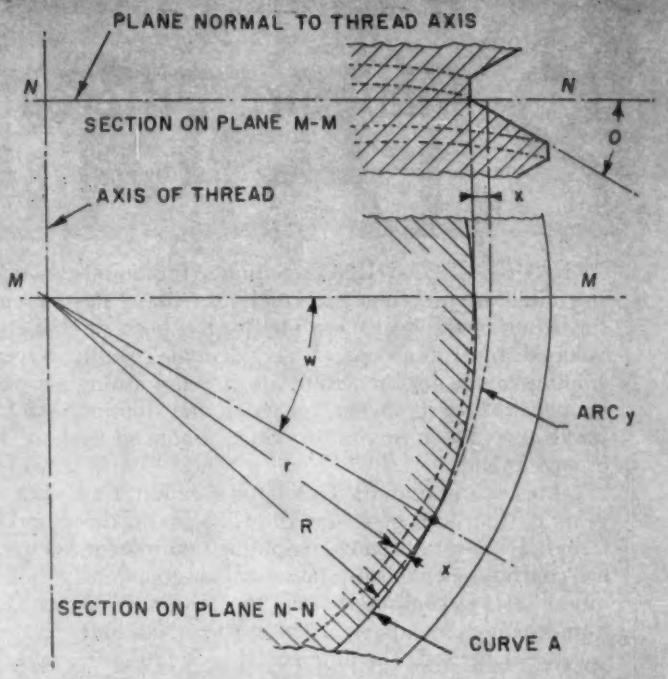
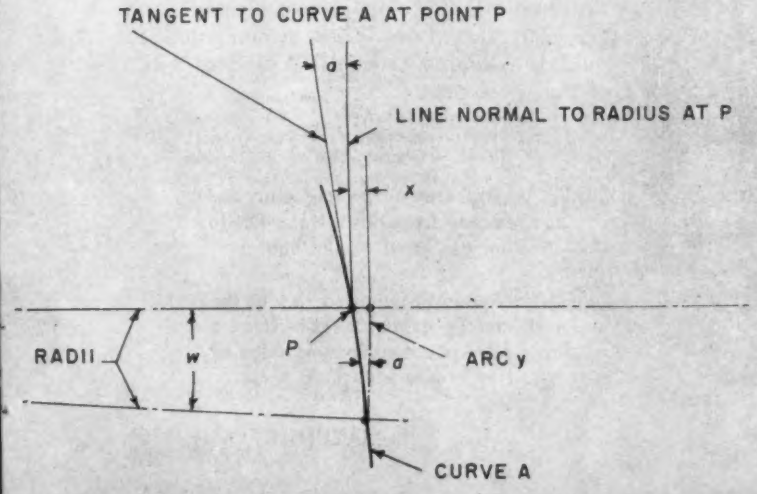


Fig. 2. Enlarged section of screw thread in Fig. 1 showing curve formed by intersection of plane (N-N) and surface of screw-thread helix.

Fig. 3. (Below) Layout used to calculate the angle (a) between curve (A) at its intersection with a radius from the center of the screw and a line normal to the radius at the intersection.



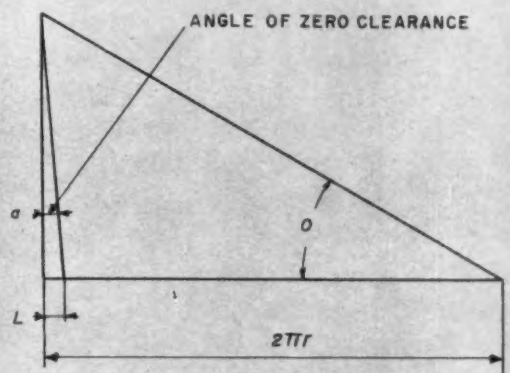
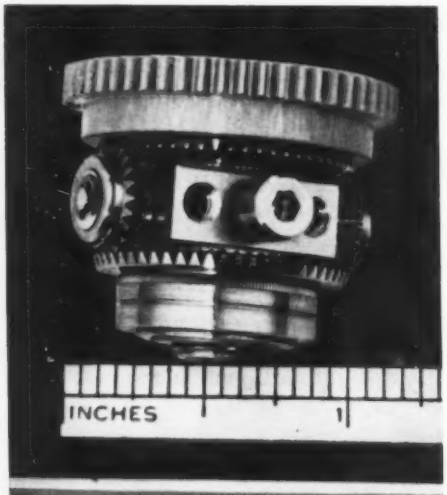


Fig. 4. (Above) Graphical solution of Equation 9. In this illustration angle (a) is termed the angle of zero clearance.

Miniature Differentials Assembled by "Knurl Broaching"

A "KNURL BROACHING" technique for mounting miniature precision gears on hubs without deformation of the gear concentricity has been developed by Librascope, Inc., Glendale, Calif. Joinings made by broaching are proving strong enough to resist severe torsional and tension forces that loosen or rupture joints produced by other methods.

Librascope applies the technique to mount tiny gears on the hubs of a new tiny two-pinion differential used in analog-computing equipment, fire-control mechanisms, flow-totalizing meters, rate-of-change computers, and other precise electromechanical equipment where shaft rotations must be compared. The differential, seen in Fig. 1, weighs only 1.06 ounces. It will accept a maximum gear input speed of 1200 rpm with a recommended maximum static load of 6 inch-ounces. Over-all length of the unit is only 0.980 inch, with a working circle of the entire differential package of 1.090 inches.



The bevel-gear hubs, to which the 1/8-inch-wide aluminum or brass ring gears are fitted, are 416 stainless steel, with diameters of 0.500 and 0.688 inch. The differentials are designed for an ambient temperature range of from −65 to +160 degrees F.

On most applications, the gears are too small for use of pins or set-screws. Cutting through the gear to provide for a pin causes loss of concentricity when thermal expansion takes place, and the precise tolerance limits may be exceeded. The result is increased backlash and, often, gear damage. The same problem exists with set-screws. Drilling and tapping the miniature walls introduce distortion, and the pressure exerted by the screw creates an out-of-round condition.

To avoid these eventualities, a straight knurl pattern is rolled on the hub surface, Fig. 2. When the hub is pressed through the bore of the gear, the knurl acts as a broach, cutting serrations in the softer gear material. A fine-pitch knurl, usually 80 pitch, is used. The knurling increases the diameter of the hub by 0.004 to 0.005 inch in the local area.

After knurling, a chip groove is machined around the hub at the leading edge of the knurl. This groove creates sharp edges which act as small broaching teeth when the hub is pressed through the gear. The groove collects the material removed from the gear, and prevents galling and spalling of the metal. If required, the gear can be removed, the chip groove cleaned, and another gear pressed on. Where a permanent fit is required, a staking groove is provided in the hub of the bevel gear.

Fig. 1. (Top) One of the ring gears has been removed from this differential to show the knurl on the hub.

Fig. 2. (Bottom) Magnified view of the knurl. Before assembly operation, a chip groove is cut at leading edge of knurl to create broaching teeth.

MATERIALS

The properties and new applications of materials used in the mechanical industries

Coolant that Stays Clean and Stops Rust

"Cold Stream," a water-soluble, metalworking coolant that stops rust, resists rancidity, reduces the causes of dermatitis, and is low-foaming, has been introduced by S. C. Johnson & Son, Inc., Racine, Wis. The product is said to stay clean for weeks even when used on cast iron. This characteristic is attributed to the fact that the formulation does not hold dirt in suspension.

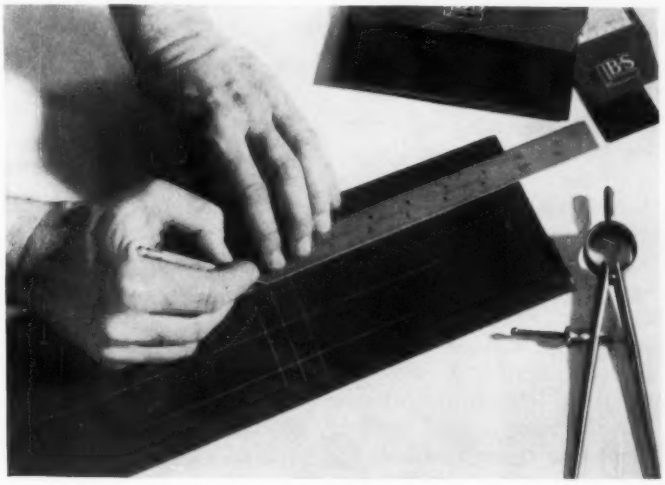
During extended production tests in metalworking plants in Wisconsin and Illinois, the new coolant completely eliminated the rust, rancidity, and dermatitis problems which had previously developed when coolants became dirty. A combination of anodic and passivating rust inhibitors is included in the formula to guard against both electrolytic corrosion and atmospheric moisture. It does not contain a bactericide.

The product is neither a sodium-nitrite coolant nor a soluble oil, but is said to combine the best cooling and lubricating features of both chemical and oil type coolants. Surface-active agents used in the formula reduce surface tension and bring the solution in close contact with the metal. This enables the product to cool more effectively than water. It can be used for all types of machining on metals, including grinding and threading, and in equipment such as turret lathes, single- and multiple-spindle automatics, and gear-cutting machines.

Precision-Ground Tool Steel is Pre-Colored Maroon

Brown & Sharpe Mfg. Co., Industrial Products Division, Providence 1, R. I., has announced an air-hardening, precision-ground tool steel that is pre-colored maroon to eliminate the cleaning, coloring, and drying required for marking ordinary flat stock. Called "Ready Mark," this stock is rust resistant, requires no greasing or degreasing, and is easily identified by its color. As shown in the accompanying illustration, pre-coloring provides a high degree of clarity in layout and allows the steel to be used immediately. The color coating does not affect heat-treatment.

Available in nearly 250 sizes ranging from a minimum cross-section of 1/8 by 1 inch in 18-inch lengths, this air-hardening stock is recommended for dies, gages, machine parts, shear blades, knurling tools, taps, and similar applications. The steel, which exhibits freedom from distortion due to hardening, will not shrink or crack



"Ready Mark" air-hardening, precision-ground tool steel is pre-colored maroon by the manufacturer to facilitate layout operations.

through thin sections when cooled in still air from quenching temperatures. The product is said to combine excellent machinability with wearing qualities midway between those of high-carbon, high-chromium steels, and manganese oil-hardening steels. It is annealed to give a fully spheroidized structure. Pieces are packaged with hardening and tempering instructions.

Air-Melted, 2 Per Cent Boron Stainless Steel Produced

The Carpenter Steel Co., Reading, Pa., has announced the commercial availability of its Type 304L stainless steel containing 2 per cent boron, air-melted in electric arc furnaces. This material is of particular significance to the commercial atomic energy field where it is used for nuclear-reactor control rods and as a shielding material. The electric furnaces used can produce melts of 12 to 14 tons. The company is currently producing the metal in two rectangular shapes—6 inches by 3/8 inch, and 3 inches by 3/8 inch.

Coolant for Abrasive Cutting

"Campbellene," a cool-blue coolant concentrate containing a deodorant, has been made available by the Allison-Campbell Division, American Chain & Cable Co., Inc., 929 Connecticut Ave., Bridgeport 2, Conn. The product is formulated for use with abrasive cutting machines and most grinding operations.

According to the manufacturer, this cooling agent keeps abrasive wheels clean and sharp, promotes rapid chip-settling, and minimizes odors. It does not foam but inhibits rusting of machine and parts. Campbellene will not support bacterial growth and thus cannot turn rancid. Under normal working conditions it should be used in proportions of 1 part coolant to 150 parts of water. The product is packaged in 1-gallon cans, cartons of six 1-gallon cans, 5-gallon pails, 14-gallon quarter-drums, and 55-gallon drums.

Heat-Resistant Alloy Steel

An air-hardening specialty steel possessing high strength at elevated temperatures has been announced by the Latrobe Steel Co., Latrobe, Pa. Designated "Dynaflex," this steel is able to resist softening upon continued exposure to temperatures up to 1000 degrees F. and provide high toughness and ductility at tensile strengths up to 300,000 psi. It can be air-hardened to full hardness even in large section sizes. This minimizes residual hardening stresses. Tempering is usually done in the 1000- to 1100-degree F. range.

Ease in forming and working, good weldability, relatively low coefficient of thermal expansion, and better than average corrosion and oxidation resistance are claimed for this steel. Nominal percentage composition is carbon 0.40, silicon 0.90, manganese 0.30, chromium 5.00, molybdenum 1.30, vanadium 0.50, and the rest, iron.

Present plans call for furnishing the steel in billets, bars, forgings, and special shapes. Typical applications are structural parts for jet aircraft.

Liquid Eliminates Effects of Organic Contamination in Plating Baths

A surface-active liquid used to overcome the effects of organic contamination in copper cyanide plating baths which are not air-agitated has been made available by MacDermid Inc., Waterbury, Conn. Called "Metex Non-Pitter N-17," it can restore brightness to dull, blotchy deposits caused by organic contamination of bright baths. In cases where carbon treatment is impossible or would be required too often, addition of the product will suppress organic contamination. It will not precipitate out or produce water breaks on plated deposits. Cleaning between copper and nickel plating is not needed when product is used.

Welding Alloy Has High-Temperature Ductility and Resists Annealing

An alloy of copper and zirconium for resistance welding has been developed by the Metallurgical Division of P. R. Mallory & Co., Inc., Indianapolis 6, Ind. Called "Mallory 28 Metal," it has high electrical and thermal conductivity coupled with high strength and hardness. Elevated temperature characteristics show good resistance to annealing and the ductility is such that the material should not check or crack when highly stressed at elevated temperatures.

The metal is recommended by the maker for applications where resistance to annealing is required, and for resistance welding where checking and cracking is a problem. It is also recommended for spot and seam welding of aluminum and magnesium alloys, and steels having low melting point coatings, such as galvanized, aluminized, terne plate, tin plate, and cadmium plate.

Low-Temperature, Air-Hardening Tool and Die Steel

"Lo-Air," a low-temperature air-hardening tool steel, has been announced by Universal-Cyclops Steel Corporation, Bridgeville, Pa. The steel is easy to machine and has good fatigue properties. Preheating for hardening is not generally necessary. Hardening is done at 1525 to 1600 degrees F. in a slightly oxidizing atmosphere, and tempering temperatures range from 300 to 1000 degrees F. For most applications, however, the best

combination of hardness and toughness is accomplished by tempering at 350 to 400 degrees F. Percentage composition of the steel is carbon 0.70, silicon 0.30, manganese 2.00, chromium 1.00, molybdenum 1.35, and the remainder, iron. Typical mechanical properties of specimens air-cooled from 1550 degrees F. and double-tempered at 600 degrees F. are: hardness, 55.5 Rockwell C; yield strength, 264,000 psi; and tensile strength, 292,600 psi. The material is available in flats, squares, rounds, and billets.

Colloidal-Graphite Lubricant

"Suspension 10," a finely stabilized, natural colloidal-graphite lubricant, has been introduced by the Joseph Dixon Crucible Co., Jersey City, N. J. The lubricant was developed for high-temperature, severe-load, industrial use. It has applications in ferrous and non-ferrous forging; in die-casting; in forming, stamping, and drawing of aluminum, titanium, and other metals; in oil and grease blending; and in the assembly and running-in of parts.

Etched Aluminum Sheet for Decorative Use

The Aluminum Company of America, 757 Alcoa Building, Pittsburgh 19, Pa., has announced the commercial availability of a new aluminum sheet material having an unusual, glittering finish. Known as "Spangle Sheet," the product is for decorative use in such applications as automotive and appliance trim, lighting fixtures, gift ware, and interior decorations. In color, the finish displays a varying range of tones.

Made by applying an acid etch to an aluminum alloy having unusually large grains, the flat sheet material is produced in mill and spangle-etch finish, plain and in color. The mill finish is for fabricators equipped to apply the spangle etch. Thicknesses range from 0.032 inch to 0.100 inch, the maximum width being 36 inches and the maximum length, 96 inches. Availability in larger sizes and gages, and coiled sheet in mill finish is subject to special inquiry.

Spotting and Corrosive Preventive

"Entek 45," a liquid additive to hot water rinses which prevents spotting and subsequent corrosion of metals, has been developed by Enthone, Inc., New Haven, Conn., subsidiary of American Smelting & Refining Co. The new product causes rinse water to shed rapidly from a metal surface, resulting in fast drying and elimination of stains. It also leaves an invisible film on the surface which protects it from tarnishing and corrosion. The additive may be used in rinses after plating, pickling, or chemical processing of any kind. One pint is required per 100 gallons of rinse water.

This product is said to be useful for protecting metals to be stored in humid atmospheres and plated parts having internal unplated areas such as plated steel tubing. The film produced does not interfere with subsequent application of most paints and enamels.

A new half-million-dollar, vacuum stream-degassing facility has been installed by Standard Steel Works Division, Burnham, Pa., of Baldwin - Lima - Hamilton Corporation, to produce low-hydrogen, electric furnace steels for highly stressed components of high-speed rotating machinery. Here, foreman checks progress of heat through viewing window as electric furnace steel is poured into degasser to make an ingot for a turbine rotor.

BERYLLIUM FORGINGS . . .

Round-Trip Tickets to Space Travel?

SPACE TRAVEL has been brought an important and practical step closer to realization by the first successful, large closed-die forging of beryllium at the Wyman-Gordon Co.—United States Air Force plant at North Grafton, Mass. This exotic metal may very well be the key to the reentry problem of space ships and missiles.

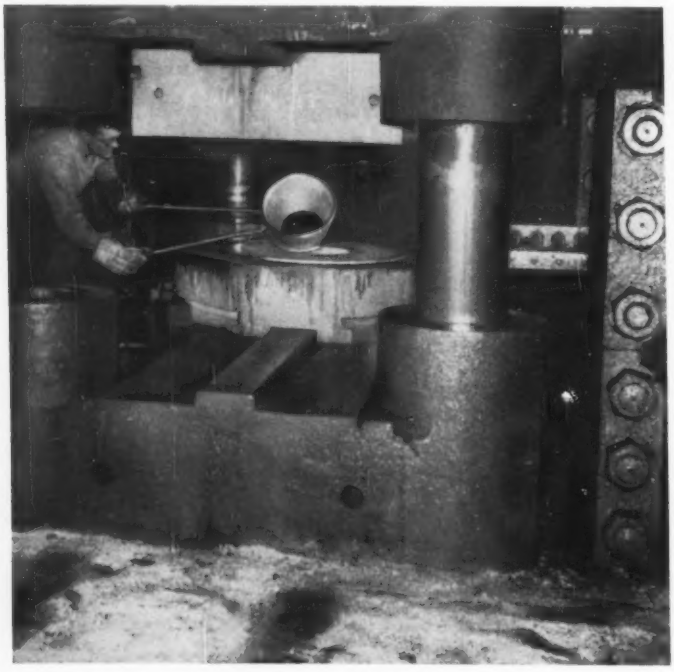
Beryllium has a number of interesting and important properties. Its density is as low as that of magnesium alloys. Its stiffness, or resistance to elongation under stress—called modulus of elasticity—is approximately one and one-half times that of steel. Its behavior in certain types of radiation makes it singularly important in a variety of nuclear devices. Heat capacity is exceedingly high. It has moderate strength and an excellent strength-to-weight ratio.

One aeronautical engineer has estimated that by using beryllium in the last stage of a three-stage moon rocket, a saving of 400 pounds in the third-stage structure is realized. This seemingly modest saving grows dramatically in significance. In the first place, it means that less fuel, to the extent of 2000 pounds, is needed for third-stage propulsion. This, in turn, is magnified to a saving of 200,000 pounds of fuel at launching.

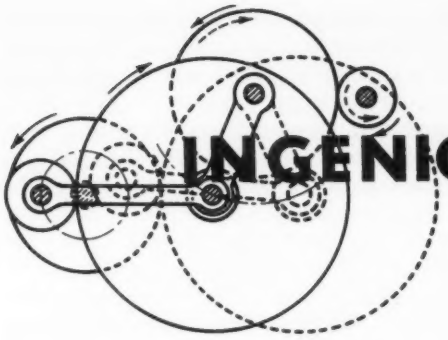
Another analysis of the structural advantage of beryllium in a transport plane indicates a weight saving of 40 to 60 per cent by substituting this metal wherever possible for conventional aluminum-alloy members. One obvious result of the beryllium design is that it affords added fuel load and increased range for the plane. These and other advantages tend to offset the higher cost of beryllium parts.

There has been, however, a formidable barrier to overcome—beryllium's extreme brittleness. The special closed-die forging technique developed at Wyman-Gordon eliminates this brittleness and produces a much more ductile material. The technique is also capable of producing large shapes that require a minimum of machining. These shapes possess a ductility and isotrophy comparable to the strong aluminum alloys, yet maintain beryllium's desirable properties.

The first beryllium closed-die forging has been a missile skirt. A large, hollow, truncated cone, the skirt was forged on an 18,000-ton press. Wyman-Gordon is quick to point out that its specific accomplishment reflects the joint developmental efforts of the Air Force, Navy, the Beryllium Corporation, Nuclear Metals, Inc., and others.



A missile skirt, shown being removed from the press, is the first large beryllium part ever forged successfully. This metal will help make possible the return to the earth's atmosphere of future space ships and missiles.



INGENIOUS MECHANISMS

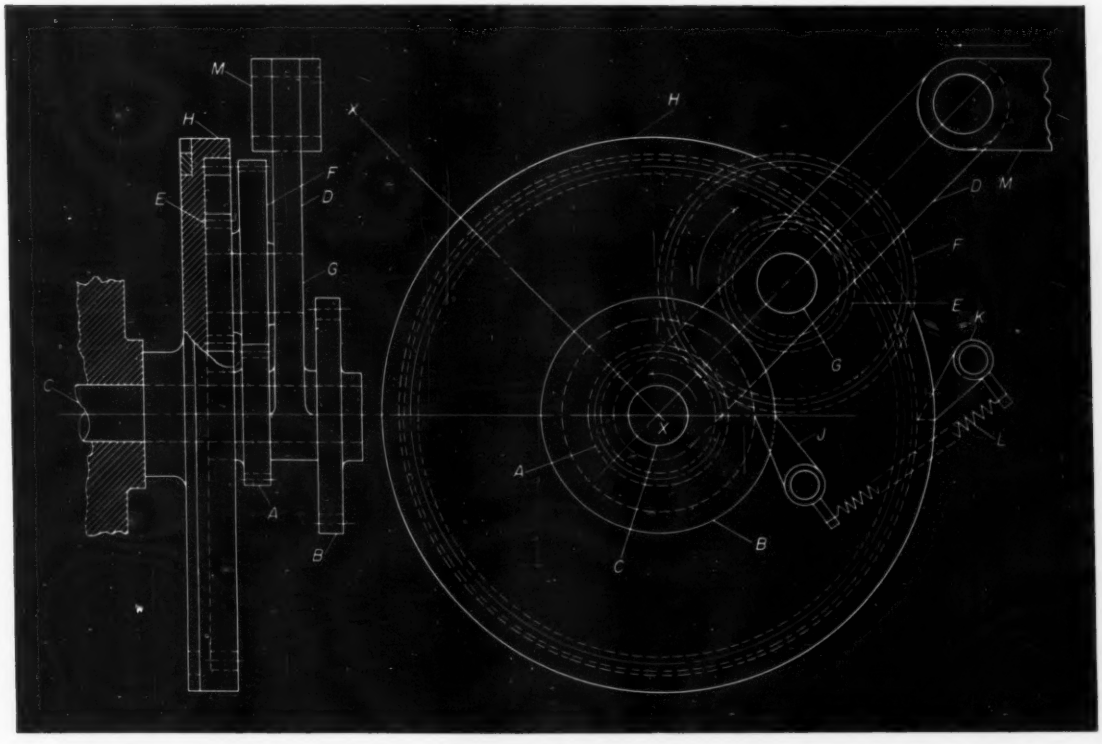
Mechanisms selected by experienced machine designers as typical examples applicable in the construction of automatic machines and other devices

Multiple-Revolution Ratchet Movement

L. KASPER, Philadelphia, Pa.

Generally, a ratchet movement is limited to a partial revolution of the driven shaft, since the rotation of the oscillating lever which carries the pawl is necessarily restricted in order to avoid a dead-center effect. The device here illustrated, however, incorporates an epicyclic gear train to produce multiple revolutions of the driven shaft with only a conventional magnitude of oscillation of the driving lever.

Gear *A* and a ratchet wheel *B* are both mounted and keyed to the driven shaft *C*. An oscillating lever *D* pivots on shaft *C* and carries two gears *E* and *F*. These gears are keyed together to rotate as a unit on stud *G*. Gear *F* rotates in mesh with gear *A*, and gear *E* with an internal gear *H*, which is free to rotate on shaft *C*. A pawl *J* engages with the teeth of ratchet wheel *B*, preventing rotation of the shaft in a clockwise direction. Another pawl, member *K*, engages with ratchet teeth on the periphery of a ring secured to left



Ratchet movement that can produce a number of revolutions of the output shaft with each working stroke.

side of gear *H*. This restricts the internal gear to counterclockwise rotation. Both pawls are mounted on a stationary part of the machine and springs *L* hold them in contact with the ratchet teeth.

In the position illustrated, the mechanism is at the beginning of its cycle. Reciprocating rod *M*, which furnishes the operating power, moves lever *D* to the left until it occupies a position centered on line *X-X*. As the lever swings to the left, internal gear *H* is locked against rotation in the same direction by pawl *K*, and gear *E*, being in mesh with the internal gear, is caused to rotate clockwise. Gear *F* rotates with gear *E* as a unit producing a counterclockwise rotation of both gear *A* and shaft *C*. On the return stroke of lever *D*, clockwise movement of the shaft is prevented by pawl *J* which engages a tooth in the ratchet wheel *B*. Since both ratchet wheel *B* and gear *A* are keyed to the shaft and held stationary, the motion of rod *D* is transmitted through gears *A*, *F*, and *E*, to produce a clockwise rotation of the internal gear. Thus, by locking gear *H*, motion is transmitted to the shaft, and by locking the shaft in the reverse direction, motion is transmitted to gear *H*. No useful work is performed during the return stroke as the shaft remains at rest during this portion of the cycle.

The number of revolutions of the output shaft is a function of the gear ratio and the stroke of lever *D*. Ratio of the epicyclic gear train *R* can be obtained by the equation:

$$R = 1 + \frac{F \times H}{E \times A}$$

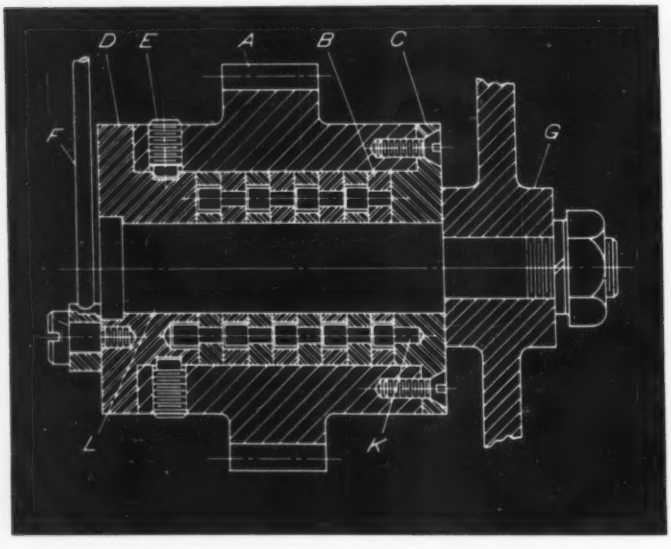
where *A*, *E*, *F*, and *H* are the number of teeth or the pitch diameter of gears *A*, *E*, *F*, and *H*, respectively. Multiplication of this ratio by the magnitude of the stroke, in degrees, divided by 360 will give the number of revolutions of the shaft for each stroke. In the arrangement shown, the ratio of the pitch diameter or gear *H* to gear *E* is 4 to 1 and that of gear *F* to gear *A* is 2 to 1. The ratio *R* is, therefore, $1 + \frac{2 \times 4}{1 \times 1}$ or 9. Since the stroke is 90 degrees, the shaft will revolve $9 \times \frac{90}{360}$ or 2 1/4 times in a working stroke.

Machine Counter with Dwell Interval Operated Through Slotted Discs

RALPH T. STEWART, Winston-Salem, N. C.

On a warp machine used in the textile industry, the counter which keeps tabs on the amount of yarn drawn is operated through a device which incorporates a series of slotted discs to obtain a desired amount of lost motion. The reason for this is that the device must reverse its rotation several turns after drawing a certain length of yarn, then must rotate forward the same number of turns before more yarn is drawn, at which time the counter must pick up where it left off.

A drawing of the device appears in Fig. 1. Main element is a gear *A*. Within the gear bore



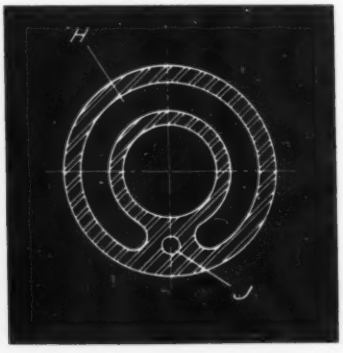


Fig. 1. (Left) When gear (A) is reversed, plate (D) remains fixed while the lost motion is absorbed.

Fig. 2. (Above) Slot (H) in the disc accommodates the large diameter of one pin, and hole (J), the small diameter of another pin.

is a series of eight discs *B*. Fastened to the right-hand face of the gear is a flanged plate *C*. On the left-hand face is a second flanged plate *D*. The latter is free to rotate, but is restricted from axial movement by a groove in its periphery which engages dog-point set-screws *E* in the gear. Plate *D* carries connecting-rod *F*, the top of which is joined to the counter (not shown). The entire assembly is bolted to the frame *G* of the machine.

One of the discs is shown in Fig. 2. Each has a large open area in the form of a curved slot *H*, and a hole *J*. The width of the slot is made greater than the diameter of the hole. This construction permits the large diameter of a shouldered pin *K*, Fig. 1, to bear in the slot of one disc, and the small diameter of the pin to fit the hole of the preceding disc. (For the first disc, the small diameter fits a hole in plate *C*. Similarly, the inner face of plate *D* has a hole accommodating the large diameter of the pin, the small diameter of which bears in the slot of the last disc.)

When gear *A* is running forward and yarn is being drawn, it revolves as a unit with plate *D* around shaft *L*, and the connecting-rod operates the counter. The line of transmission extends from the gear to plate *C*, then to each shouldered pin and disc, and finally, to plate *D*. Then when the gear must be reversed for several revolutions, plate *D* remains fixed and the counter does not operate. The reason for this is that as the reversal is set up, the pin in plate *C* must be dragged from one end of the slot in the first disc to the other before the first disc joins in this reverse rotation. Similarly, there is a delay of almost a complete revolution before each of the following discs in turn starts its reverse rotation. Thus, a total of approximately seven revolutions of backward turning is available if required.

When the gear again runs forward, plate *D* remains fixed until all the pins in turn have been dragged to the opposite end of their respective disc slots. At that time, yarn again is drawn from the machine and plate *D* resumes its movement, and the counter again operates.

Cermets Look Promising to Ford Researchers

Titanium-carbide tools that far outwear even the best tungsten-carbide grades for semifinish- and finish-machining have been perfected by the metallurgy department of Ford Motor Co.'s Scientific Laboratory.

This development marks an important forward step in freeing the United States from dependence on imported and highly strategic tungsten, according to Dr. Michael Ference, Jr., the laboratory's director. A second important point is that titanium-carbide tools should be competitive in cost with present tool materials. He classed these titanium-carbide tools as probably the most successful cermets to be produced since the development of tungsten carbides in the tool and die grades. (The term "cermet" is a contraction and combination of the words "ceramic" and "metal."

Dr. Ference also announced that an extensive research program has been established in the laboratory to evaluate the over-all usefulness of the titanium carbides within the Ford Motor Co. There are no plans at present for offering the new tools for sale outside the company, although the possibility of licensing other companies to produce them commercially is being explored.

The material is a dense structure, very fine-grained, with a uniform dispersion of the titanium carbide in a metal binder consisting of nickel and molybdenum. Steel cutting grades have a hardness range of 90 to 93 Rockwell A. At present, a nominal composition of 80 per cent titanium carbide, 10 per cent nickel, and 10 per cent molybdenum has been fully developed for semifinish- and finish-machining. Other combinations are being studied for possible use for rough-machining operations as well as for interrupted cuts.

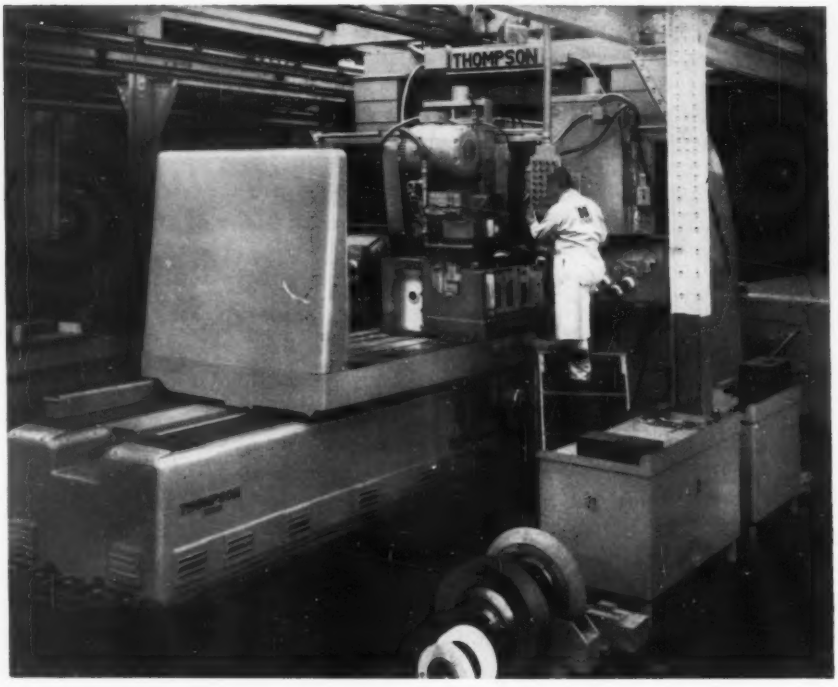
Dr. Michael Humenik, Jr., supervisor of the ceramics and powder metallurgy group, under whose direction the titanium carbides were developed, said that results obtained from standard machinability tests showed a major improvement in tool life over steel-cutting tungsten-carbide grades. Actual production operations in the Rouge and other Ford plants were used to test the titanium carbides. The tests involved the use of brazed as well as mechanically clamped bits.

On semifinish- and finish-steel-turning operations at normal cutting speeds, titanium-carbide tools proved to be up to seven times better in tool life than the usual grades of tungsten carbide. On finish-turning steel at high speeds, titanium carbide demonstrated itself to be superior to all of the ceramic tools tested.

One test matched two commercially available ceramic tools and a C-8 tungsten carbide, finish-turning an 8620 steel forging gear blank, Bhn 170-207, at 1040 sfpm (surface feet per minute), using a 0.013-inch feed and 0.010-inch depth of cut. The C-8 cut 1090 pieces per tool corner, one ceramic cut 1232 pieces, and the other 1666. The titanium carbide cut 6317 pieces, almost four times as many as the best ceramic, and nearly six times more than the C-8 tungsten carbide.

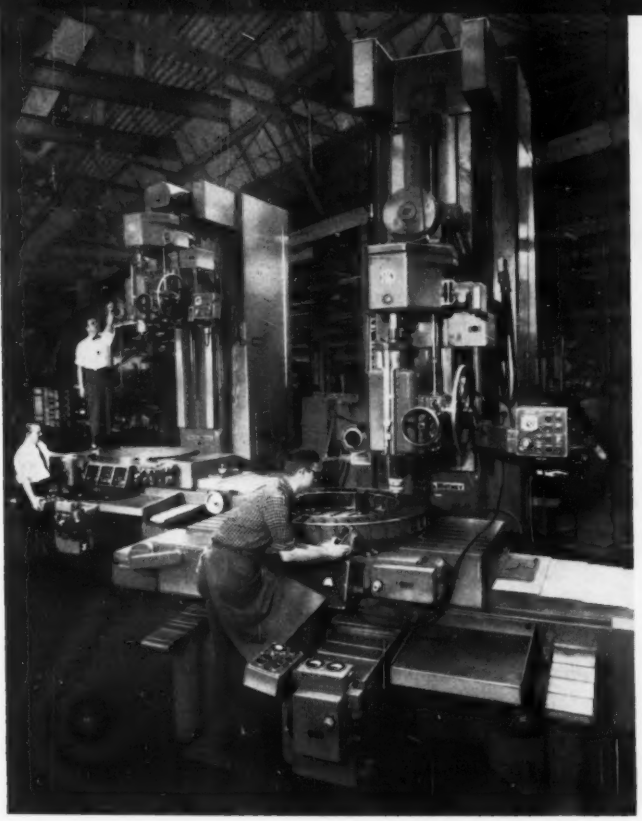
In Shops Around the Country

Camera highlights of some interesting operations performed in various metalworking plants throughout the nation by unique applications of machines and tools

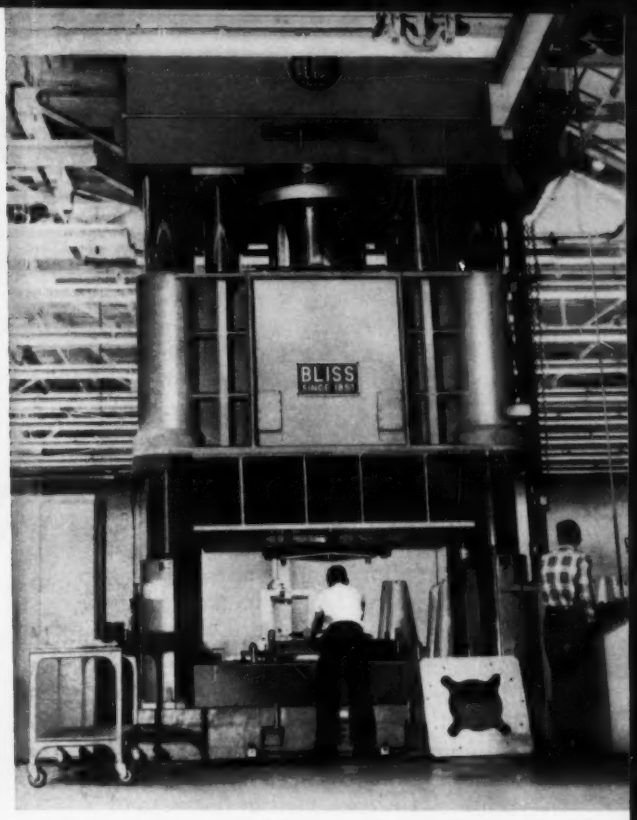


WAY GRINDER—One of the largest machines at the Heald Machine Co., Worcester, Mass., is this 75-ton Thompson surface grinder. Principal use of the equipment is to grind machine tool ways, substantially reducing the amount of hand scraping. Prior to installation, a 15-ton concrete base, lined with 6 inches of cork to absorb vibration, was prepared. There are three spindles, for horizontal, vertical, and angular grinding.

CARRIAGE-MOUNTED DRILL—A Walker-Turner 20-inch drill press drills and taps vertical holes in the same setup in which horizontal holes are completed in the transfer cylinder of a large printing press, at the Cleveland plant of the Harris-Seybold Co. The drill is mounted on a carriage that rides rails along the fixture base. Press is equipped with a reversing motor, pneumatic feed, and quick-change chuck.



WEST HARTFORD TO EAST HARTFORD— Two of six new jig borers, reported to be the largest such machines in the free world, have now been delivered to Pratt & Whitney Aircraft, East Hartford, Conn., by their builder, the Pratt & Whitney Co., Inc., West Hartford. The machines tower 16 feet above the floor, weigh 26 tons each. They use an electronic measuring system and are controlled either by a perforated tape or by telephone type dials.



MODEL T TO NIKE—At Charlotte, N. C., in a plant that once turned out Model T Fords, the Douglas Aircraft Co. is producing the Army's Nike-series missiles. This 1500-ton, hydraulic double-action Bliss press leads a versatile life deep-drawing and stamping missile parts. When used for stamping, blank-holder movement is locked out, and a pressure of 2100 tons is available. An instrument section-spacer stamping for a Nike-Hercules appears in front.

BOLT TESTER—Critical fatigue properties of large-diameter aircraft bolts are checked on this new giant Schenck tension-tension tester at the Standard Pressed Steel Co., Jenkintown, Pa. The machine has more than twice the capacity of any other fatigue tester used in the fastener industry. It can apply a 132,000-pound load 2000 times a minute, and in addition to production quality control, it will be used for research on big-bolt behavior.

TOOL ENGINEERING *Ideas*

Tools and fixtures of unusual design and time- and labor-saving methods that have been found useful by men engaged in tool design and shop work

Diamond Dresser Preserves Distance Between Wheel and Work Center Line

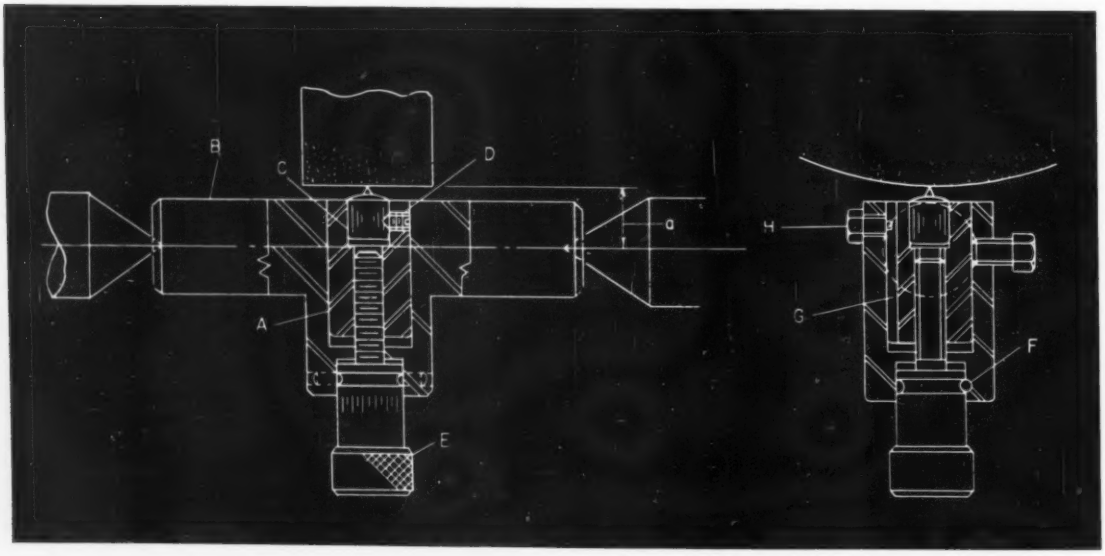
CLIFF BOSSMANN, Dayton, Ohio

A diamond wheel dresser for a cylindrical grinder automatically re-establishes the relationship between the wheel and the work each time the wheel is trued. Intended primarily for large-lot grinding operations, the device reduces the amount of diameter checking necessary.

Adapter *A* is contained in the stem of T-block *B*. A counterbore in the front of the adapter receives diamond holder *C*, which is secured in position by set-screw *D*. Running through the back of the adapter is a tapped hole which engages the threaded shaft of adjusting screw *E*.

Part of the barrel section of the adjusting screw enters the bottom of the stem. Pin *F*, fixed in the stem, intersects a groove in the barrel, thus preventing the adjusting screw from moving axially when it is rotated. The adapter, on the other hand, moves axially but cannot rotate, because of the engagement of slot *G* along the outside of the adapter with dog-point set-screw *H*.

When the wheel requires truing, the T-block is mounted between the work-centers of the machine. A clamp secures the stem of the block to a toolpost, to prevent any radial movement of the diamond relative to the wheel. For the initial wheel truing, the wheel-head is advanced slightly. Then by rotating adjusting screw *E*, the diamond is brought up to the wheel, and the table is reciprocated. Once distance *a*—the radius of the ground work-piece—has been re-established, set-screw *D* is locked, and the adjusting screw needs no further rotation for subsequent truing cycles. All that is necessary is that the wheel-head be advanced slightly into the path of the diamond.



Once adjusting screw (E) is pre-set, the wheel-head is advanced for each truing cycle. Distance is automatically re-established by the diamond dresser.

Sides of Work-Piece Utilized to Facilitate Piercing

RICHARD MINSER, Cleveland, Ohio

When the edge of a hole in a stamping is coincident with a side wall, this edge can sometimes be sheared with only the metal in the side wall acting against the punch. A die used to perform such an operation on a part for an automobile door latch assembly is here illustrated.

The blank is first drawn by a conventional progressive die into a small irregular cup (Fig. 1). Two subsequent operations are required to produce the opening shown at *X*. On two sides, *X-1* and *X-2*, this opening extends to a side wall, leaving no room for die edges when the opening is pierced. The die shown in Fig. 2 is used to produce these holes to close tolerances with high-volume production.

Upon the shoe *A* of a standard two-pin die set a hardened tool-steel block *B* is bolted and doweled. This die-block not only holds and locates the part but provides edges for shearing two sides of the hole *X-3* and *X-4*.

Pad *C* is mounted on the punch-holder, being held in place by stripper bolts and backed by compression springs. When the ram descends, this conventional spring pad, which is the first moving member to contact the part, holds it in position on the die-block. Arranged about the work-piece are two cam-operated, backup pads *D* and *E*. The relative positions of these spring-loaded assemblies are indicated at the left in Fig. 2, and the construction of pad *D* is seen at the upper right.

The base of the pad *D-1* is a piece of cold-rolled steel with a longitudinal U-shaped slot. A cold-rolled steel plate is welded to one end of the base to reduce the slot opening. The area of this plate that contacts the plunger is carefully casehardened to provide wear resistance. Plunger *D-2*, also of casehardened steel, is located within the slot in the base. One end is hard-faced with tool-steel welding rod, and a large round head is welded to the other. The plunger is maintained in position by a light-duty spring *D-3*.

A second plunger *D-4*, fitted at the opposite end of the base, is similar to plunger *D-2*, except that a flat is milled on the top to prevent rotation. This plunger is also casehardened full length and the end is hard-faced. Removable plate *D-5* retains plunger *D-4*. Positioned between the two plungers is a short but very heavy die spring *D-6*.

The entire assembly is retained in place and protected from dirt and shavings by the cover *D-7*. One end of this cover has a welded piece which completes the closure around plunger *D-2*, and the opposite end has a flat-bottomed extension which seals the opening above plunger *D-4* and prevents its rotation.

The punch assembly shown at the lower right in Fig. 2 is somewhat similar in construction to the backup pads. A rectangular-shaped slot extends across the top of the base *F-1*. The opening in the plate that is welded to one end of this base is rectangular to prevent rotation of the punch *F-2*. The edges around this opening are case-hardened for wear resistance and are fitted with felt washers or wipers (not shown) to remove abrasive dust or dirt.

The punch is machined from a square bar of tool steel and heat-treated. This member is square at one end for about one-third of its length, round for most of the remainder, and ground square at the opposite end to form a cutting edge. Washer *F-3* is mounted on the punch shank with a press-fit. A return spring *F-4* bears against both this washer and an end-closure plate *F-5*. This plate, made of tool steel and hardened, is doweled and held in place by cap-screws. Accurate location of the closure plate is necessary since it serves to direct the punch to the work-piece. Cover *F-6*, made of cold-rolled steel, encloses and protects the assembly.

In operation, a work-piece is placed on the die-block and the press is tripped. As the ram descends, the spring-mounted pressure pad *C* contacts the work. Further ram travel causes cam *G*—which has a replaceable tip of bronze alloy for wear resistance—to advance plunger *D-4* toward the work-piece. This movement is transmitted through the heavy spring *D-6* to the plunger *D-2*. Plunger *D-2*, in turn, compresses the light return spring *D-5* and moves into contact with the work.

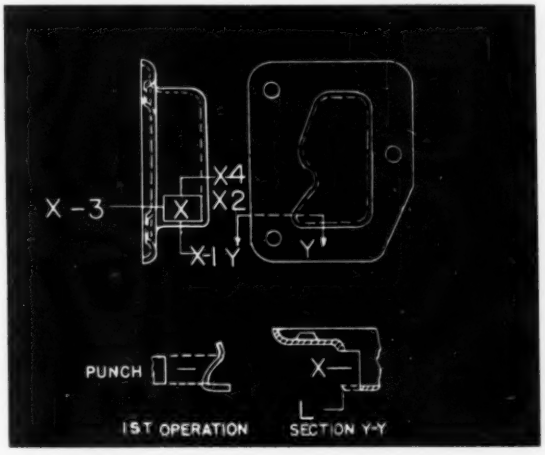


Fig. 1. This stamping for an automobile door latch assembly is pierced adjacent to two side walls. A second trimming operation completes the opening (X).

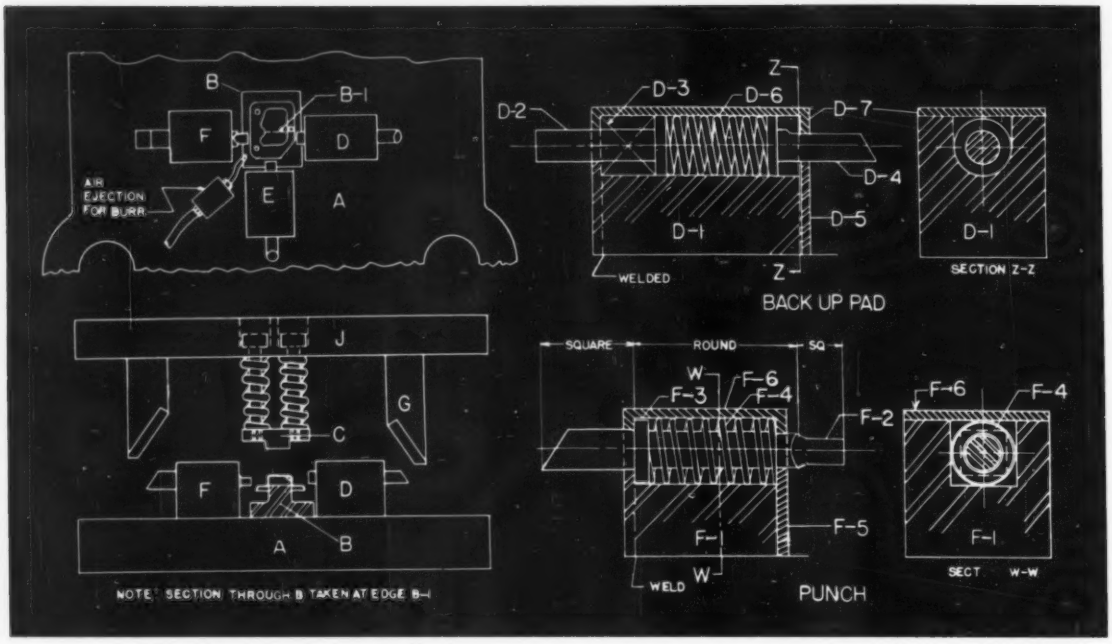


Fig. 2. Die at the left employs the resistance offered by side walls in piercing the stamping shown in Fig. 1. Construction of the punch and a backup pad are detailed at right.

Another cam simultaneously moves the plunger *E* in the same manner until it also bears against the work. The plungers, pressure pad *C*, and the die-block *B* restrain the part, supporting it from all sides. Such outside support enables the punch to act against the metal in the sides adjacent to the edges (*X-1* and *X-2*) being sheared.

With still further travel of the ram, the punch *F* is actuated to pierce the hole at *X*. Then, as the ram retracts, punch *F* and plungers *D* and *E* are moved back by their return springs. This action releases the part, and it is readily removed from the die. The slug is disposed of by a blast of air. A second and final operation, that of trimming the hole to shape (Fig. 1), is accomplished in a conventional die.

• • •

Tips on Setting Up a Centerless Grinder

Spoiled work produced by through-feed centerless grinding can more often be traced to a faulty setup than to an improper or poor wheel. Norton Co. offers these setup tips:

Adjust the height of the work blade so that the center line of the work is above the center line of the grinding and the regulating wheels a distance equal to the work radius. This applies to work up to 1 inch in diameter. However, for any diameter of work, the distance should never exceed 7/8 inch. If the work is too high, chatter marks may be produced. If too low, the work will be ground out-of-round.

For small-diameter work, the thickness of the blade portion that supports the work should be slightly less than the work diameter. For large-diameter work, use the thickest blade available. A 25- to 30-degree blade angle is sufficient—if too steep, chatter marks may result.

The work should contact the blade approximately in the middle of the beveled face. With the work resting on the blade and the blade slides free, advance the regulating wheel slowly, pushing the work up the bevel until the point of contact is at, or just above, the middle of the blade.

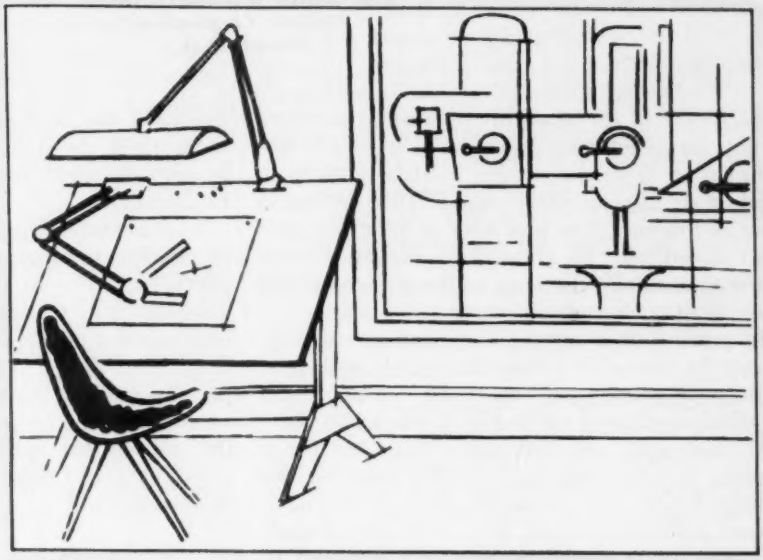
To true the regulating wheel, swivel the truing slide to the angle of inclination of the regulating wheel, and set the truing diamond over an amount equal to the height of the work center line above the grinding and the regulating wheel center line.

True the grinding wheel with a slight taper so that grinding stops when the work is 1/2 to 1 inch from the exit side. This eliminates spirals or feed lines in the work.

Adjust the guides on the regulating-wheel side so that the front guide is behind the wheel face by an amount equal to one-half the amount of stock to be removed during the pass; and set the rear guide 0.0005 to 0.001 inch behind the regulating wheel. Adjust the guides on the grinding-wheel side to a clearance of 1/64 to 1/32 inch.

MACHINERY'S

Reference Section



WHAT THE DESIGNER SHOULD KNOW ABOUT PRODUCTION

PART 8—ASSEMBLY OF MACHINED PARTS

May 1959

What the designer should know about production—Part 8

ASSEMBLY OF MACHINED PARTS

THEODORE KOERNER, Jr., Technical Specialist
Staff Master Mechanic's Office
Chrysler Corporation
Detroit, Mich.

A SURVEY of the assembly operations involved in any manufacturing process will generally disclose many instances where a slight change in product design can effect considerable savings in time and money. The problems pointed out here refer specifically to automobile manufacturing, but are essentially the same as those encountered in many other industries.

In general, it is more economical to use cap-screws for assembly rather than studs and nuts. Additional purchasing, receiving, storing, and handling operations are required when two parts (stud and nut) are used rather than one (cap-screw). In attaching the cylinder head to the engine block, for example, cap-screws have proved more economical, Fig. 1. In the production area too, a double operation is required in that both the stud and the nut must be driven into place.

There is an advantage, however, in using studs as locators where several parts are involved in an assembly. For example, in assembling the steering-column bracket on Chrysler automobiles it was necessary to insert a screw through the following parts: the steering-column outer and inner brackets; the instrument panel and reinforcement; and the nut, which was retained in a bracket fastened to the instrument-panel reinforcement.

This assembly operation was difficult because of possible misalignment of one or more of the parts. Extra people were required to perform the assembly and to replace nuts dislodged during unsuccessful attempts to align the parts. It was discovered that if a stud was started into a nut prior to making the sub-assemblies, all the parts would be kept in reasonable alignment during the subsequent assembly operations. The last assembly could then be easily made by the use of an acorn nut.

Machining After Assembly

Occasions may arise which will require machining a part after it has been assembled to one or more other parts. This may be caused by the fact that some assembly or joining processes tend to distort or even destroy the dimensional accuracy of previously machined surfaces. Examples of this condition are:

Fig. 1. Cap-screws, shown in place before being tightened, have proved more economical for attaching the cylinder head to the engine block. In the past, studs and nuts were employed.

1. Welding or brazing one part to another, causing distortion of finished surfaces and shrinking of hole sizes due to the application of excessive heat.

2. Assembling one part to another with a press- or shrink-fit, causing hole distortion if the inner mating part has thin wall sections.

Another reason for machining after assembly is to maintain an extremely accurate relationship between parts which may have to mate with the assembled parts. An example of this is the Plymouth rear main-bearing cap, which is machined after it is assembled to the engine block. A bored hole is machined in the cap to receive the oil-pump shaft. The oil-pump shaft must be located in close relationship with a mating part in the engine block.

Often, what would be a simple machining operation on a single part becomes a difficult one on an assembly. Location, clamping, and clearances can become problems, and minor product-design deviations may greatly affect production processes.

In the case of the Plymouth main-bearing cap, clearance is the problem. Unless the cap-screw head is precisely located, a corner of the head will protrude over the area of the hole to be bored, as can be seen in Fig. 2. In this position, the boring tool will strike the cap-screw head and be broken. At the present time, Plymouth engine production requires a man to inspect and adjust this screw on each engine to assure clearance for the boring-bar. By moving the bolt-hole location only a slight amount, this problem could be entirely eliminated.

Shearing of Mating Parts at Assembly

If a shaft has been cut off leaving a sharp edge, only a slight "bump" will upset or burr the edge enough to prevent the shaft from entering a hole. To minimize this condition, a 1/8-inch by 45-degree chamfer is usually provided on the shaft ends. Then, any bump will usually distort only the small-diameter end of the chamfer, and still permit the shaft to fit a hole with the planned clearance. If the clearance is very small, or if a press-fit is required, such a chamfer may prove unsatisfactory for the following reasons:

1. A bump on the large-diameter end of the chamfer, although this edge is much stronger and less apt to be distorted than a square-cut edge, may still distort the shaft enough to destroy the desired clearance.

2. In the case of a press-fit, this edge is sharp enough to prevent proper alignment, and may cause shearing, galling, or shaving as the press-fit is made.

Several alternatives may tend to correct this condition. For instance, a 3/16-inch by 15-degree chamfer will provide the large-diameter end of the chamfer with more strength to resist upsetting, in addition to being further from the end of the shaft and thereby less apt to be bumped. Also, the chamber will be less sharp and therefore have less tendency to shear, gall, or shave, in addition to providing a better lead to assist proper alignment.

A rounded corner on the shaft end has an advantage over a chamfer, due to the elimination of the troublesome sharp edge. It is, however,

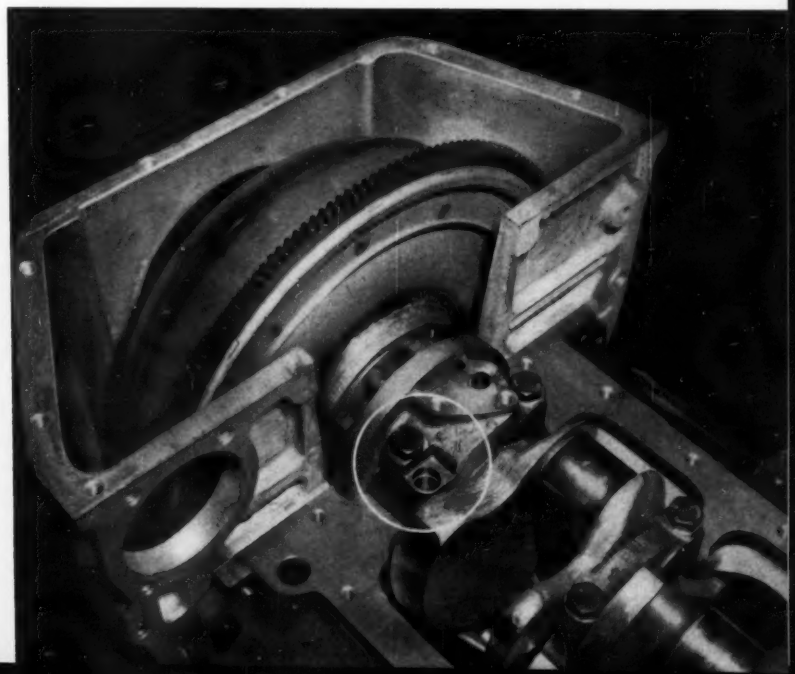


Fig. 2. The main-bearing cap attaching screw in the encircled area is shown out of position and interferes with the subsequent line-boring of the adjacent hole for the oil-pump driveshaft.

Fig. 3. Rounded edges on the wrist-pins prevent cutting or galling the soft aluminum pistons during assembly.

sometimes difficult to control economically the radius of the corner in production.

In severely troublesome cases the shaft can be made a few thousandths of an inch smaller in diameter for a short distance from the end. This pilot surface will freely enter a hole, properly align the parts, and allow a press-fit with a minimum opportunity of shearing or galling.

The Chrysler Division experienced difficulty in press-fitting the sharp-edged, steel wrist-pin into the soft aluminum piston. This condition was corrected when economical means were obtained to produce rounded edges on the wrist-pins, Fig. 3. Also, looseness and other difficulties were experienced due to shearing and galling in the press-fit assembly of vibration dampers. This was corrected by changing the product design to provide a pilot on the end of the crankshaft. The process and method of operation must be analyzed to determine which application would be most beneficial and economical for each part.

Nut and Screw Location

Nut and screw locations which are not easily accessible may result from the design of the part itself, or interference from a previously assembled part. For example, the attaching screw for the transmission-case and torque-converter housing is not easily accessible because of the housing casting itself and other mating parts, Fig. 4. A special power wrench used to tighten the screw must operate in a right-angle position and in a very confined area. With these design limitations, the power wrench does not have sufficient output to tighten the screw as required. Therefore, final tightening is needed with an open-end wrench.

Front screws for the tappet cover plates are not easily accessible because of interference. A special swivel-socket power wrench must be used at an angle to tighten these screws. Also, side screws for the tappet cover plates are extremely difficult to tighten. Even with the substitution of shorter screws and the use of specially ground sockets, this operation is very costly and time-consuming. Because of wrench slippage in starting the screw at an angle and the thin walls of the socket, breakage is very high.

Nuts for securing the carburetor are probably the most difficult to tighten in the entire engine assembly. Because of the limited area available, due to the overhang of the carburetor body itself and other interferences, the nuts must be started by hand, then tightened by means of a nut-rake. A nut-rake is a tool somewhat resembling a file, consisting of a file handle and a long, narrow blade with very coarse saw teeth cut into one side. As the nut-rake is pushed along the side of the nut, the teeth engage the corners of the nut and turn it on the stud.

There are many types of power wrenches available for tightening screws and nuts. Some are quite ingenious in design for purposes of overcoming normal obstacles. Also, special

wrenches are available to transmit power at various angles. Swivel sockets, universal joints, and in some cases, even flexible shafts are employed for tightening screws and nuts. Generally, however, there is a minimum area and accessibility required for the use of power tools. Unfortunately, there are still many operations where time-consuming hand wrenches are required.

Insufficient Socket Clearance

In addition to inaccessibility of nut and screw locations, insufficient socket clearance can be a severe problem. Far too many of the sockets used to tighten screws and nuts must be specially ordered or reworked to provide thin wall sections and special shapes.

Insufficient socket clearance, as in the case of nut and screw inaccessibility, may also be caused by either the design of the part itself or by prior assemblies. Some production examples of insufficient socket clearance are: the engine adapter-plate attaching screw, which is too close to a raised rib on the engine block; the mounting screws for the torque-converter housing which do not clear the shallow recesses enough to allow a standard wall thickness for the socket; and the starter-motor mounting screw which is extremely close to the body of the starter. In such cases, special thin-wall sockets must be used, as in Fig. 5.

Thinning of the socket walls naturally results in excessive breakage. Some production areas have reported breakage rates as high as fifty sockets per day. The logical solution to this problem appears to be thicker walls, but thicker wall sections alone will not solve the entire problem, because other factors are involved.

Combining Multiple Parts into a Single Part

While it is obvious that elimination of one of the parts to be assembled would certainly minimize assembly problems, this solution is seldom attempted until trouble is encountered.

One example of the combination of parts is in the Plymouth engine clutch housing and dust-cover. The clutch housing has two holes machined for construction purposes, which later must be plugged to keep out dust. Previously, two plugs were inserted in these holes, and when the dust-cover was assembled, it had to clear these plugs. By adding two ears to the cover, plugs are eliminated and the holes are covered.

However, in most cases, such a part combination is not practical. In fact, some applications require the opposite—an increase in the number of parts. An example of this is the Chrysler water pump, which was previously made in one piece, and is now being made in three parts. This change was made because the lower scrap rates and less complicated machining setups provide greater savings when compared with the additional assembly costs required with one-piece

Tolerances Causing Assembly Problems

Overlapping high and low tolerances on mating parts may cause problems such as slip-fits becoming press-fits, and press-fits becoming "impossible." Also, unnecessarily close tolerances may result in excessive costs. For example, the drawing of the Plymouth water-pump outlet to the manifold was dimensioned according to standard practice except that the hole diameter was expressed as a decimal, and no special mention was

Fig. 4. A right-angle power wrench must be used to tighten the transmission mounting screw seen in the encircled area because of the interference created by previously assembled parts.

made as to the tolerance. The vendor observed the decimal dimension of the hole, and also the standard note present on most drawings that decimal dimensions have a tolerance of plus or minus 0.005 inch. To maintain this tolerance, the vendor processed the part with a reaming operation. When this unnecessary tolerance was brought to light and the drawing changed, the vendor omitted the reaming operation and was able to reduce the unit price by $0.009. This does not seem like a lot of money but since two of these parts are required per engine, a 500,000 engine production year means almost a million pennies.

The Chrysler oil-stick retainer tube is an example of the need for close tolerances, both in machining the hole in the block and in producing the tubes. The tube need be only a little smaller or the hole a little larger and the result would be a loose tube. Reversed conditions would result in a bent tube.

Assembly Automation

Automation in assembly is just as practical as in machining and stamping if the design of the parts and assemblies permits the necessary clearance and accessibility. Also, provisions must be made for other variables such as the production volume, the number of parts to be assembled, the design of the parts, etc. Feeder mechanisms for sorting, orienting, and single feeding of nuts, studs, screws, bolts, bushings, bearings, pins, plates, tags, rivets, keys, springs, washers, and a host of other small, machined parts are presently being used in all types of industries. Mechanisms to drive, press-swage, crimp, cement, solder, braze, weld, screw, rivet, and otherwise join or assemble parts are also in widespread use.

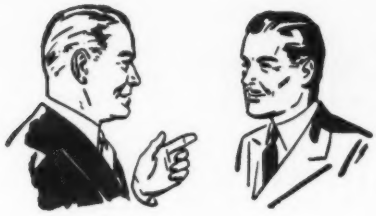
Again, two of the major causes limiting the application of automation to assembly operations are lack of clearance and accessibility. In regard to clearance, sufficient area must be available for the tool holding the part to be assembled, and adequate space provided to perform the work. Regarding accessibility, provisions must be made for an unobstructed "straight-shot" at the work.

Valve springs are an example of how a minor product-design change would greatly facilitate production. However, product-design considerations might show good reasons why it would not be feasible to make such a change. The spring is too long in its open position to permit the washer hole to engage the valve-stem. On the eight-cylinder engine head, with the valve-stem and spring riding the conveyor at an angle, the washers have a tendency to drop off and fall to the floor. Even those washers staying relatively well in position need some adjustment prior to spring compression and key insertion.

The Chrysler six-cylinder engine head permits the valve-stem and spring to stand in a vertical position. Therefore, even though the valve-stem does not engage the hole in the washer, no problem is involved. The washer hole is positioned directly over the valve-stem so that a straight compression engages the two parts for the insertion of the locking keys. Also, the DeSoto eight-cylinder engine has relatively shorter springs and the washer hole does engage the valve-stem even with the spring uncompressed.

Problems similar to this impede assembly operations. Even when assembly is manual, these problems are difficult to resolve. Sometimes they are of sufficient magnitude to preclude the automating of an assembly operation.

Fig. 5. The power screwdriver must be equipped with a special thin-wall socket where there is insufficient clearance for a standard socket.



Talking With Sales Managers

BERNARD LESTER
Management Consulting Engineer

Don't Let Promotion Outstrip Product Performance

SALES of many consumer items bought for personal use—such as drugs, cosmetics, and cigarettes—face a bumpy ride because buyer satisfaction falls short of anticipation built up by inflated promotion. The product is over-sold, the purchaser under-satisfied. The market is a seething mass as one brand rises to the surface, then disappears, yielding its place to another. One-time buyers flourish. The creation of loyal customers suffers. Selling expenses skyrocket.

The sale of industrial equipment does not suffer from over-promotion. More often the reverse is true. But in numerous instances it does suffer from under-servicing, which prevents a high degree of customer satisfaction—after the equipment is installed and during its life. A job well engineered, sold, and installed may give only ordinary results.

Let us cite one instance.

One sales manager's business during much of last year fell off more steeply than the over-all activity in his line of equipment. A belated investigation revealed loss of prestige. The decline had been gradual, and apparently was well underway before it was identified and appraised.

As the sales manager expressed it: "This present year we have been terribly busy overcoming last year's erosion in our reputation, which came about because our attention was fixed so completely on getting business, particularly from sources new to us, rather than servicing old customers. We were like the kid who tries so hard to win the game that he forgets about playing it."

Continuing satisfaction with installed equipment is vital to future machinery sales—particularly so, since production equipment is not used up like hair rinse, but continues to display a nameplate that will either praise or damn the supplier. In the case of breakdown, you make a hit by prompt and effective service. But mild dissatisfaction year after year undermines your reputation and ruins sales imperceptibly.

Several machinery builders lost their position in sales standings last year because they lost sight of two simple principles. They are:

1. The buyer's good will depends on his continuing to profit by the use of the equipment.

2. The buyer's good will is especially important because, with few exceptions, he buys again and again.

Hence, gaging customer good will and measuring the services that support it should be an important consideration. That this job appears commonplace may easily cause neglect. Test out procedures such as these:

Check your market-research people to make sure they are alert to buyers' opinions on what you build and to how you help the user.

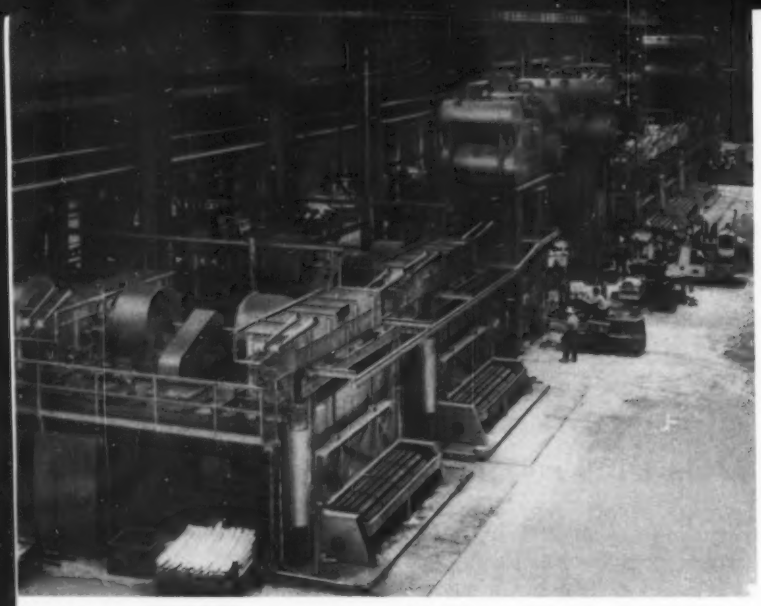
Check sales calls to find if they are properly spread between past buyers and fresh prospects.

Check on the means used to follow up on installations that have been made. There is much advantage for the salesman himself in asking the customer how his equipment is working. At least one machine tool builder adds to his reputation during depressed times by systematically writing or calling on his users to find out how to help them get more out of machines bought long ago.

Check the accuracy and promptness of your order service. Work of a routine nature, no matter how important, has a tendency to bog down. Systems are inclined to multiply. It is very easy for us to lose our sensitivity to the urgency of the customer's need *after* the turmoil of buying. Loss of interest in the customer after the sale is tragic.

Check your methods of classifying and analyzing your troubles to see that data obtained is used to correct weaknesses in current equipment and forestall failure. Some mass-produced articles have defects that are continually repeated. Customers get disgusted and select another brand.

Of course, as machines take over more kinds of work, their maintenance enlarges in importance and scope. But what easily escapes us is the obvious truth that, besides sales engineering, service is a large coefficient of successful operation, and very vitally concerns increased sales.



Forging Aluminum on Advanced Design Presses

THREE HYDRAULIC PRESSES incorporating advanced design features have been placed in operation at the Erie, Pa., forging plant of Kaiser Aluminum & Chemical Corporation. Their installation, along with furnaces and other supporting equipment seen in the heading illustration, completes an approximate 5-million-dollar expansion program that was undertaken when Kaiser Aluminum purchased the plant in 1956.

With this equipment, the plant is able to produce draft-free, low-draft, commercial, and precision forgings of improved quality, superior properties, and more intricate design, at lower cost. Hot and cold impact extrusions up to 16 inches in length can also be made on the presses.

Designed and built to Kaiser Aluminum specifications by the E. W. Bliss Co., the hydraulic presses have capacities of 8000, 5000, and 3000 tons. The largest press, Fig. 1, can be operated at 5000 or 3000 tons, as well as full capacity and the 5000-ton press at 5000, 3000, or 2000 tons.

An outstanding feature of these presses is the precision control of the ram speed which permits accurate flow of the metal that is so essential in forging. Rapid traverse of the ram can be varied up to 600 inches per minute, and the pressing speed is infinitely variable from 0 to 60 inches per minute on the 5000- and 8000-ton presses, and from 0 to 180 inches per minute on the 3000-ton press. Speeds are controlled either by manual operation or a pre-set automatic cycle. Completely automatic cycling, which can be actuated by foot pedal, also controls the ram dwell (maintaining the pre-set tonnage for a pre-selected time). Automatic, 500-ton stripping and ejecting members can be pre-set to operate at any position during the stroke, and can perform forging operations in themselves.

A centrally located, hydraulic accumulator station, powered by three 800-hp pumps, operates the presses. The 8000-ton press, which has a 96- by 72-inch bed, is equipped with two 1000-

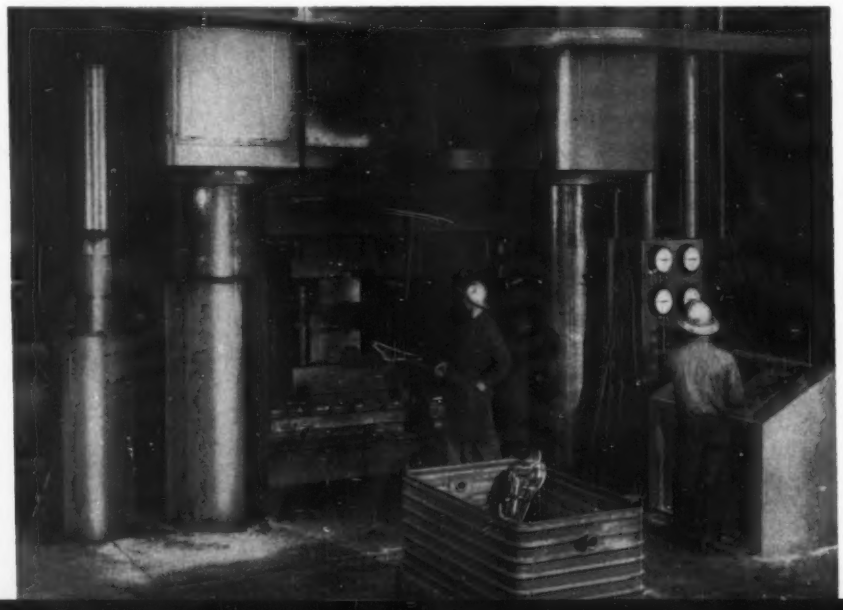


Fig. 1. Hydraulic press of 8000-ton capacity has two 1000-ton side cylinders to permit horizontal forging and use of split dies

ton side cylinders. This permits using split dies and performing horizontal forging, preforming, stock gathering, bending, piercing, and upsetting operations. Over-all height of the 8000-ton press is 48 1/2 feet—33 feet above and 15 1/2 feet below the floor level. It weighs approximately 750 tons, the ram alone weighing 106 tons.

Five gas-fired, radiant-tube furnaces of the conveyor hearth type, made by the Surface Combustion Co., have been provided to handle the maximum production of the three hydraulic presses. A 4000-pound capacity manipulator handles larger forgings, and a 1500-pound capacity manipulator and monorail system are employed to handle smaller forgings.

With the new installation and improved techniques, aluminum forgings are being produced with better surface finishes. Fewer heats are required for finish-forging, and die life has been substantially increased. While the superior qualities of forgings are the major selling point, it is now possible in many cases to quote competitively with parts produced by other methods (or made from other metals) on price alone.

Some of the commercial parts now being produced in this plant are: connecting-rods for compressors, electrical connectors, hardware items, electrode holders, grease-gun cylinders, textile-machine parts, end plates for printing rolls, and clutch components.

Progress in Machine Tool Distribution Discussed

The theme of the Thirty-Fifth Spring Meeting of the American Machine Tool Distributors Association, held March 18 and 19 at the Sheraton-Park Hotel, Washington, D. C., was "Progress in Machine Tool Distribution in Proposals—in Industry Relations—in Government." James O. Ellison, Association president, presented the opening address entitled "A Third of a Century of Progress in Machine Tool Distribution." Mr. Ellison discussed how the early machine tool salesman differed from the present day sales engineer, and predicted what he might be like in the next third of a century. He also mentioned that the study of future changes would be a continuing project.

A panel discussion on "The Whys and Wherefores of Government Machine Tool Programs" was moderated by James C. Kelley, general manager of the Association. The panel was composed of: Edwin McElwain, Covington & Burling; John H. Williams, Department of Defense; Howard W. Smith, Office of Civil and Defense Mobilization; George E. Merryweather, the Motch & Merryweather Machinery Co.; Walter B. Stults, Select Committee on Small Business of the United States Senate; N. A. Olsen, Business and Defense Services Administration; and J. Herbert Myers, the Cincinnati Shaper Co.

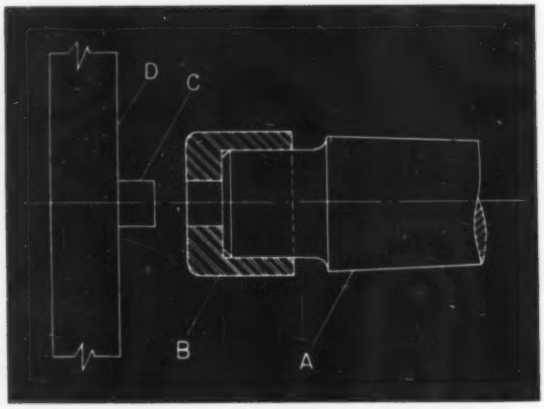
The Honorable Leo A. Hoegh, director, Office of Civil Defense Mobilization, discussed the specific part the machine tool industry plays in today's defense picture. Mr. Hoegh also pointed out that our free economy has been progressing steadily at an average rate of around 3 per cent per year. Historically, this growth has been divided roughly into the following ratio: 1 per cent from increases in the labor force, and 2 per cent from increased productivity. To boost our annual growth rate, a major share would have to come from increased productivity, and the machine tool industry would have to play an important part in such an achievement.

Ralph J. Kraut, president of the National Machine Tool Builders' Association, was the moderator of a panel of machine tool builders who explored ways of improving builder-distributor selling. This panel included Kenneth M. Allen, Rockford Machine Tool Co.; Donald R. Danly, Danly Machine Specialties, Inc.; Thomas T. Kling, the Lodge & Shipley Co.; and Daniel R. Weedon, the Blanchard Machine Co.

Twelve members of the AMTDA received awards for outstanding proposals entered in a nation-wide contest. The purpose of this contest was to advance the art of preparing machine tool proposals and to show industry how modern machine tools can reduce costs, increase efficiency and productivity, and why they are a good investment. Equal awards were made for proposals in three major classes of machine tools.

The first-place award in the category on general-purpose tools costing not more than $10,000 was won by Machinery Associates, Inc., Wynnewood, Pa., for a proposal on a Cincinnati Shaper Co. shear. Wm. Halpern & Co., Inc., Mount Vernon, N. Y., won first award in the category on general-purpose machine tools costing not more than $50,000 for a proposal on a lathe made by the Cincinnati Lathe & Tool Co. In the third category, general or special-purpose machine tools costing $50,000 or more, first award was won by Marshall & Huschart Machinery Co., Chicago, Ill., for a proposal on a planer type milling machine made by the Giddings & Lewis Machine Tool Co.

SHOP KINKS



Arbor and sleeve for locating holes to be bored in a work-piece secured to the faceplate of a lathe.

Lathe Arbor and Sleeve for Locating Bored Holes

FRANK L. RUSH, Woodbourne, N. Y.

Accurately located bores must often be produced in work-pieces while they are clamped to the faceplate of a lathe. One method of positioning the part on the faceplate for machining these holes is by means of the arbor and sleeve here illustrated.

Arbor *A* is made of steel and precisely machined to fit the tailstock of the lathe. Tool-steel sleeve *B* is ground to a snug fit over the arbor. A hole in the sleeve is ground 0.0004 or 0.0005 inch larger than the toolmaker's button *C*, which is used to set up the work-piece *D*. The sleeve is knurled on its circumference to permit a better grip during the alignment of the part.

In operation, the work-piece is placed so that the toolmaker's button is approximately centered on the faceplate. Then, the arbor is positioned in front of the toolmaker's button over which the sleeve is then slipped and rotated. If the sleeve does not bind on the button, the work-piece is accurately located for boring the hole.

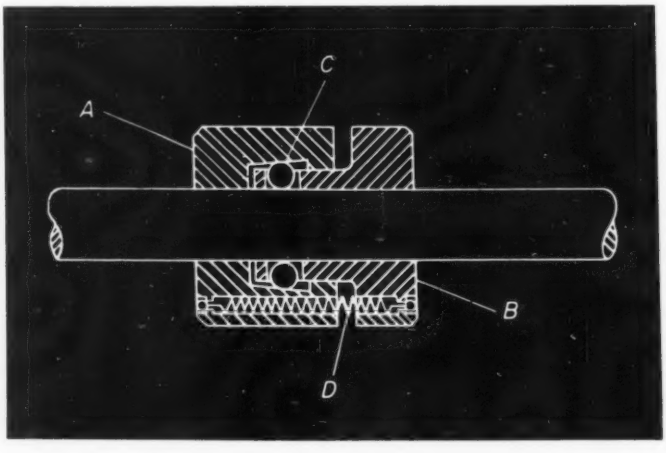
Self-Locking Stop-Collar

ERNEST JONES, New York City

A stop-collar that will lock automatically when placed at any point along a cylindrical rod or shaft is shown in the accompanying illustration. Although easily adjusted to any desired position, the collar is self-locking and resists pressure applied in either direction.

The collar consists of a counterbored cylindrical body *A* which has an under-cut recess bored at a slight taper. A plunger *B*, bored to fit the shaft, has four or more radial holes each drilled to receive a steel ball *C*. Three or four springs *D*, located in holes counterbored as shown in parts *A* and *B*, pull these members toward each other. Eyes formed at the ends of the springs retain them in position. Hardening will increase the life of the parts. For gripping purposes, the periphery of members *A* and *B* should be knurled.

In use, separation of parts *A* and *B* will unlock the collar from its shaft and permit repositioning. Any force pushing either part toward the other



Stop-collar that is self-locking when a force is applied in either direction. It is easily repositioned.

will relock the collar to the shaft. In tests, this stop-collar has been applied successfully to stationary shafts and to rotating shafts with no vibration. Vibration will cause collar to creep.

Arbor Press Loading Determined by Torque Wrench

H. WILLIAMS, New York City

A simple arbor press has been adapted to handle work on which the force applied must be known. The conversion was made by welding a hexagonal-head nut to the end of the drive-shaft. Then, after the ram has been brought down to the work, a torque wrench can be slipped over the nut and used to apply the final pressure. When the torque wrench is not needed it can be removed and the arbor press used in the conventional manner.

Actual force applied to the work can be calculated using the formula

$$F = \frac{T \times 12}{r}$$

where

F = force, inch-pounds;
T = torque-wrench reading, foot-pounds;
r = radius of press drive-gear, inches.

This formula will yield a figure that can be used as a constant for the particular press in question. For example, if $r = 3/4$ inch then

$$F = \frac{T \times 12}{3/4}$$

$$F = T \times 16$$

Therefore, to determine the force applied to the work in this press it is only necessary to multiply the torque reading by a constant of 16.

A torque-wrench controlled arbor press has been found useful for testing springs, as the applied pressure is known and the compression can be measured. This setup has also proved useful when straightening shafts. The pressure is gradually increased, and the shaft is then rechecked to determine the progress of the correction.

Simplified Calculation of Spindle and Cutting Speeds

BUCKLEY SULLIVAN, Cleveland, Ohio

Two simple formulas, committed to memory, will enable both spindle and cutting speeds to be readily calculated in terms of each other. Cutting speed in surface feet per minute (sfm) can be found by taking one-quarter of the product of the work diameter D in inches and the spindle speed in revolutions per minute (rpm):

1. $$sfm = \frac{D \times rpm}{4}$$

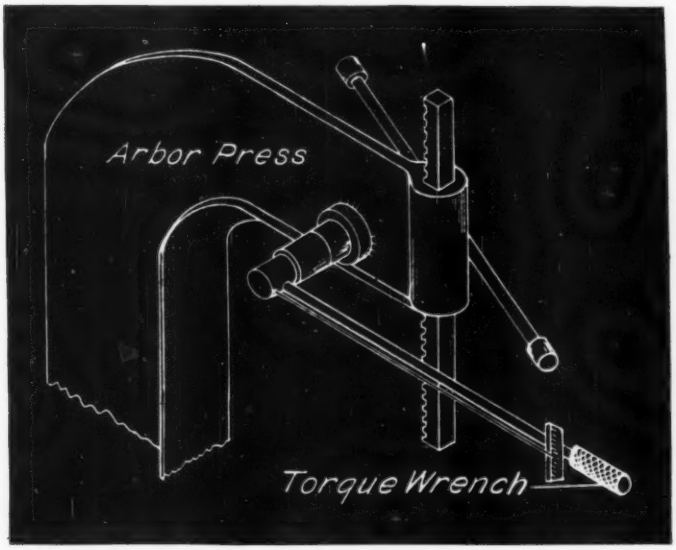
Spindle speed can be determined as follows:

2. $$rpm = \frac{4\ sfm}{D}$$

Although these formulas will give approximate values, they are accurate enough for most shop work. For more accurate applications, the following formulas should be used.

3. $$sfm = 0.2618\ D \times rpm$$

4. $$rpm = \frac{3.8197 \times sfm}{D}$$



Torque wrench engages a nut welded on the drive-shaft of this arbor press. By applying final pressure with the wrench, the force exerted on the work can be determined.

LATEST DEVELOPMENTS

Machine tools, unit mechanisms, machine parts, and

Cincinnati "Intraform" Machine

A process of "chipless machining" has been announced by the Meta-Dynamics Division of the Cincinnati Milling Machine Co., Cincinnati, Ohio. It consists of cold-forming cylindrical work-pieces such as tubes or rings to obtain profiles on the inside diameter. The machine (Fig. 1) which performs this operation is appropriately named "Intraform." In performing a chipless-machining operation with this equipment, a mandrel is inserted in the work prior to its being squeezed by rapidly pulsating dies. At the completion of the operation, the profile of the mandrel has been reproduced in the inside diameter of the part, as shown in Fig. 2. Tensile strength and surface finish have been improved. Inside-diameter profiles produced by the unit range from heat-exchanger fins to the highly accurate lands and grooves in rifle barrels. Typical examples of "Intraform" formed work-pieces are shown in Fig. 3.

There are four forming dies, arranged as shown in Fig. 4. These dies pulsate rapidly while revolving around the outside diameter of the work. Dies are mounted on cams which contact a series of free-wheeling, hardened-steel rollers, such as those indicated diagrammatically at *A* and *B* in Fig. 5. These dies are located in the machine headstock. The top surface of the cam has the form of a sine curve, and at no time loses contact with the rollers. A smooth, continuous, squeezing action results which occurs more than 1000 times per minute.

Contact with the rotating dies causes the part and mandrel to revolve, but at a somewhat slower speed than the dies. At the same time, the work is fed over the mandrel and toward the rear of the headstock as indicated by the diagrams, Fig. 4. Since only the work-piece has a feeding traverse, long work may be internally formed with a short, relatively inexpensive mandrel.

Intraform forming can be applied to any type of ferrous or non-ferrous parts ranging from about 1/8 inch to 5 inches in diameter, and made from pre-machined blanks, tubing, castings, forgings or extrusions. In addition to forming profiles in open or blind holes, laminated tubing can be made by form-bonding two or more metals. The bond is exceptionally strong and tight. Forming operations for which a mandrel is not required also may be performed on tubular and solid work. These include pointing, reduction of diameters, and forming of taper and radius.

Intraform machines produce excellent finishes. Rifle barrels, for

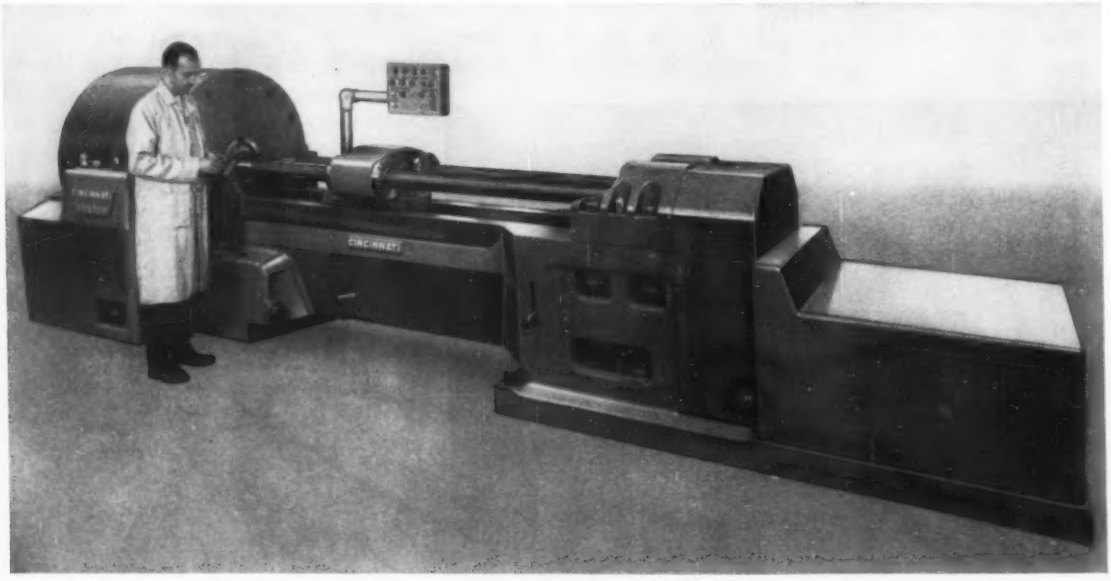
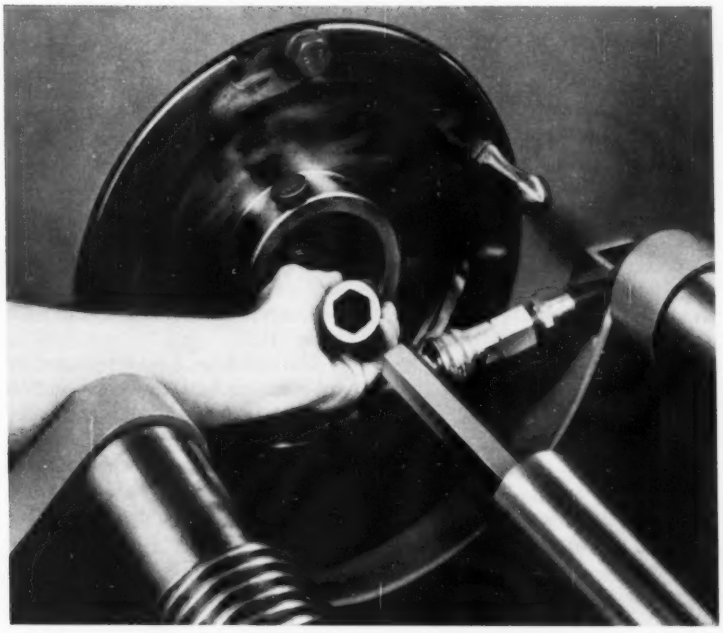


Fig. 1. Intraform machine for "chipless machining" announced by the Meta-Dynamics Division of the Cincinnati Milling Machine Co.

IN SHOP EQUIPMENT

material-handling appliances recently introduced

Edited by FREEMAN C. DUSTON



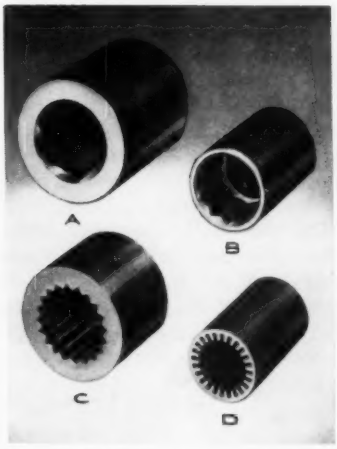


Fig. 2. (Left) Close-up of work-piece and tapered mandrel of Intraform machine which produces hexagonal form in work bore in sixteen seconds

Fig. 3. (Above) Typical examples of work-pieces with internal profiles produced by machine in Fig. 1

example, have a 32-micro-inch finish after drilling and reaming. After the Intraform operation, which forms the rifling, the finish averages 7 to 8 micro-inches. Accuracy, too, can be of the highest order. Some types of parts have been held to 0.0002-inch limits for the inside-diameter profile.

Intraform cold-forming also has the advantage of improving physical properties. Tensile strength can be improved as much as 30 per cent. In addition, the continuous flow lines created in the profile-formed area greatly add to the fatigue life of the part in service.

Quite often, less stock is required than for conventional machining. For example, a high-speed steel pin, turned from stock

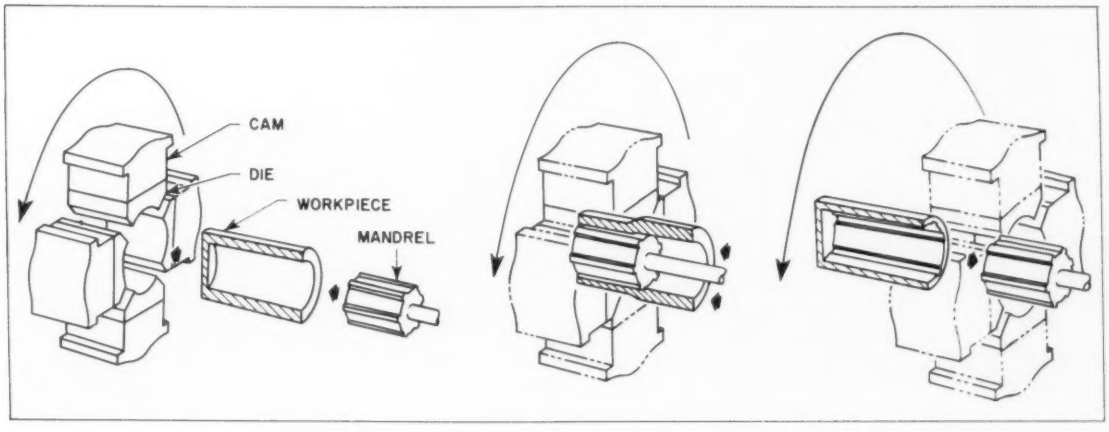


Fig. 4. Diagrams showing, from left to right, the successive positions of work and mandrel in producing inside-diameter profiles by Intraform forming

8 1/2 inches long, can be Intraform formed from 4 7/8-inch lengths.

Referring to Fig. 3, the trimming die *A* is form-tapered to a hexagonal shape on the inside diameter at a production rate of 250 pieces per hour. Setup time for this job is fifteen minutes. Material is AISI 8840 alloy steel. The inside profile of the pocket *B* is produced by Intraform forming at the rate of 320 pieces per hour. Material is AISI 4140, and the setup time, fifteen minutes.

Ratchet teeth on the inside of the part shown at *C*, Fig. 3, are Intraformed at a production rate of 300 parts per hour. Setup time is fifteen minutes. Material is AISI C-1020. The fins on the inside of copper heat-exchanger tubes like the one shown at *D* are formed by the Intraformer at a production rate of 16 inches of tubing formed per minute. Setup time for this operation is thirty minutes.

Circle Item 565 on postcard, page 181

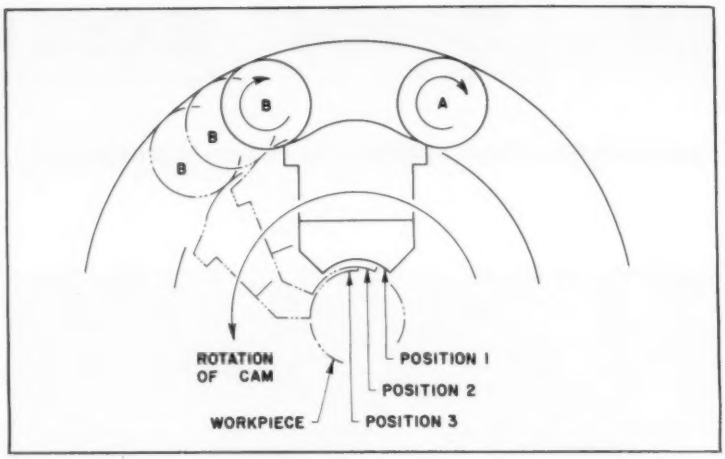


Fig. 5. Diagram illustrating function of rollers on cams in applying a smooth, continuous, squeezing action to the dies of Intraform machine

Vertical Boring Machines for Processing Flywheel Housings

Two custom-built, vertical, precision boring machines have recently been completed by the Ex-Cell-O Corporation, Detroit, Mich., for processing cast-iron and aluminum flywheel housings. Each machine is capable of rough- and finish-boring and chamfering as many as nine holes, ranging in size from 3/8 inch to 5 3/8 inches in diameter in one pass.

The machine base and standard columns are of heavy construction. Standard, hydraulically operated vertical slides carry standard Ex-Cell-O precision boring spindles, mounted in clusters. The design facilitates maintenance and has the flexibility necessary to accommodate changes in product design.

In operation, the flywheel housing to be processed is manually loaded and roughly located. The operator initiates the hydraulically operated clamping cycle, causing elevators to raise the part to the machining position, where pins provide positive location. Wedge clamps lock the work in position. Bore sizes are held to tolerances as close as plus or minus 0.0005 inch and locations within plus or minus 0.0015 inch.

Circle Item 566 on postcard, page 181

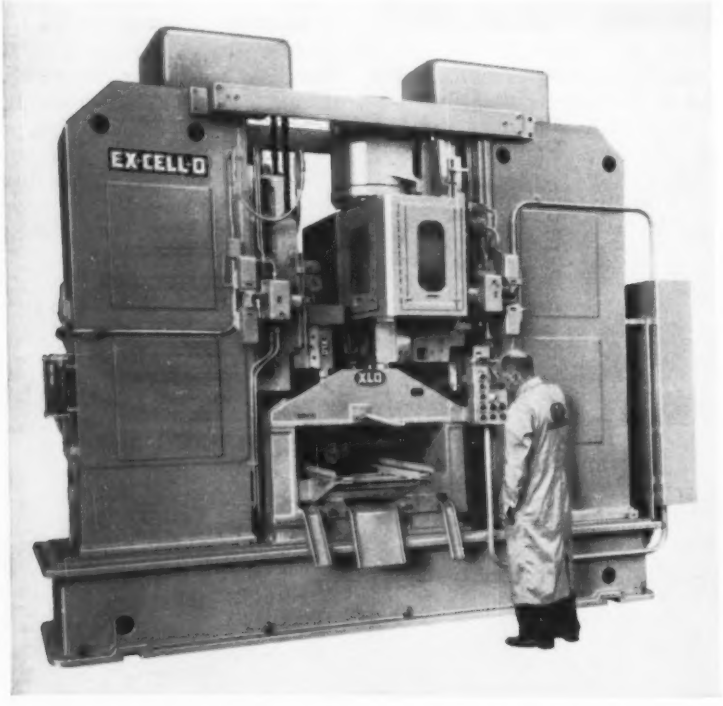


Fig. 1. Ex-Cell-O custom-built vertical precision boring machine for rough- and finish-boring large flywheel housings

Fig. 2. Typical cast-iron component processed on machine shown in Fig. 1

"Hydrolair" Custom-Built Laboratory Press

A small, compact, air-powered hydraulic press to be used for laboratory testing and research work in plastics molding, as well as for certain types of small-production work in the plastics and rubber fields, has been built by American Steel Foundries, Elmes Engineering Division, Cincinnati, Ohio. One of the outstanding features of this "Hydrolair" press is its remarkable operating economy. Instead of the usual hydraulic motor and pump, the unit is equipped with a special Elmes-patented air-hydraulic intensifier. This device enables the press to take its power right from the regular shop air-line, or from a small air compressor.

Hydrolair presses are made both in standard models, which meet most requirements, and in custom-built designs like the one here illustrated. This 100-ton unit was specially designed for the experimental laboratories of a leading producer of chemical and plastic materials. To meet work requirements of extremely high operating temperatures (900 to 1000 degrees) and an exceptional degree of accuracy in platen movement, the press was made with special adjustable gibs and machine columns with flat portions on which the gibs provide maximum bearing. Additional supporting gibs contact the round portion of the columns to help prevent binding and cocking of the platen. Although the standard Hydrolair low-pressure control circuit has proved adequate for laboratory work, special laboratory type reading gages of an unusually high degree of accuracy were substituted on this press for the conventional gages.

Standard models are built in 30-, 50-, 75-, and 100-ton capacities, equipped with manual control, with or without hot plates. The 50-ton model is also available with conveniently arranged electric push-button control.

Circle Item 567 on postcard, page 181

Federal Press Type Resistance Welder

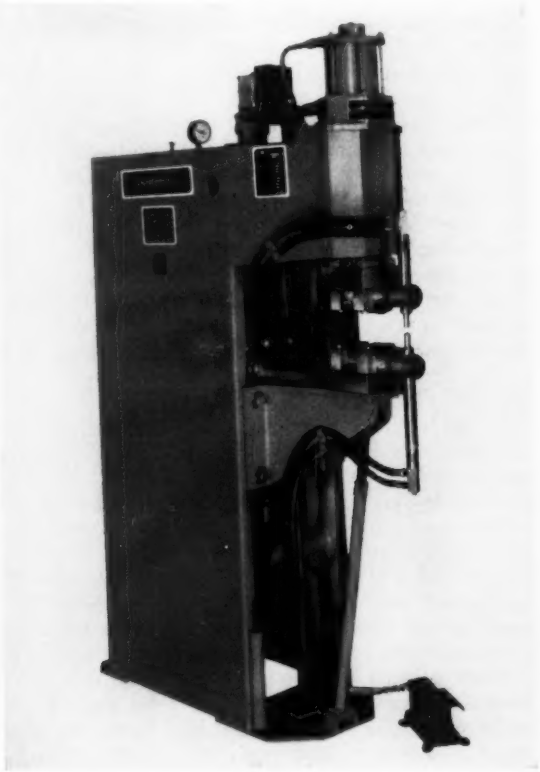
A standard line of press type resistance welders of new design is being introduced by the Federal Machine & Welder Co., Warren, Ohio. These machines are available in four sizes ranging from 30 to 500 kva, inclusive.

Each size machine in this line is available as a spot welder, a projection welder, or a combination spot and projection welder in a range of standard throat depths, electrode forces, and transformer sizes.

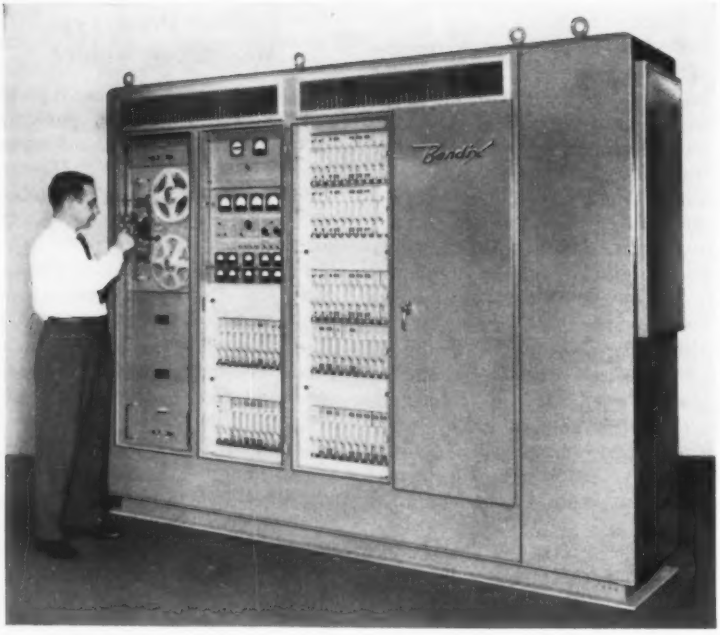
Design features include a one-piece, slim-line frame that takes less floor space and gives greater working area. There is also a new anti-friction slide which is easily adjusted for wear or take up, and requires no removal of covers. The new integral transformer and lower arm are designed to give higher performance and maximum power efficiency.

Circle Item 568 on postcard, page 181

"Hydrolair" 100-ton laboratory press for plastics molding, testing, and small-production work



Press type welder of line brought out by the Federal Machine & Welder Co.



Bendix four-axis machine-control unit which simultaneously controls tools in four planes for machining parts requiring twist type cutting operations

Bendix Four-Axis Numerical Control for Machine Tools

A numerical-control unit for directing four independent motions of a machine tool simultaneously is available from the Industrial Controls Section, Bendix Aviation Corporation, Detroit, Mich. This equipment is designed for the numerical control of high-precision, four-axis milling machines. It can be used in horizontal, vertical, longitudinal, and tilted positions to machine engine mounts, bulkheads, airfoil contours, or any type of part requiring twist type cutting operations to close tolerances.

The input to the control unit is punched tape. The high-speed tape reader permits reading 300 lines per second in the forward direction and 600 lines per second in the reverse direction. An automatic tape rewind allows the operator to remove the part as the tape is being rewound. The unit provides high-speed parity checking of a new control tape as it is being mounted on the reader.

Four decimal indicators show position-location readings continuously on all four axes. This assists in setup and in manual operation of the machine tool during simple machining. Four auxiliary tape-controlled functions automatically regulate coolant flow, spindle speed, tool changes, table indexing, chip conveyor, etc.

In operation, the control tape, containing in condensed and coded form all information necessary to machine a specific part, is first mounted on the tape reader. The operator then positions the machine tool cutter manually to the setup point corresponding to the initial position on the tape and depresses the tape "start" button. Automatic machine operations then begin.

The first block of information on the tape is read by a photoelectric tape reader and held in temporary storage. At the same time, each line is checked to insure that the tape is punched and read correctly. Should an error be detected in reading the storaged tape, the control unit will stop the machine the instant the last correct block being processed is complete. The operator may then erase the incorrect block from temporary storage by depressing a "clear" button. When the source of the error has been determined and corrected, the operator can automatically return to the last block and resume tape operation. No loss of synchronization or damage to the part occurs. This error-detection circuitry prevents reading any erroneous information into the interpolator.

The interpolator accepts the block information from temporary storage and generates continuous trains of pulses (linear value 0.0002 inch, tilt value 0.01 degree) for each of the four axes of motion. The number of pulses generated for each axis is proportional to the distance to be moved along the X, Y, Z, and tilt axes, respectively. The rate at which these pulses are generated is proportional to the programmed cutter-feed rate.

For any one of the four axes, pulses from the interpolator are then fed into an error register. As these pulses enter the register and build up a count, a proportional signal is amplified and delivered to a torque motor. This motor operates a proportional control servo valve which controls the flow of oil to a hydraulic rotary motor, and thus drives the machine slide.

Attached to each slide is a feedback device, called a "Quantizer." The Quantizer is geared to the machine tool-slide and produces feedback pulses, each of which corresponds to the same amount of travel as a command pulse. The error register keeps a running count of the difference between the number of command and feedback pulses. When the Quantizer feeds back to the error register the identical number of pulses originally specified for machine motion, the signal to the hydraulic valve drops to zero, stopping the servo motor, lead-screw rotation, and in turn, that particular machine axis.

While this motion is being executed, the photoelectric reader advances an additional block, loading temporary storage with the next straight-line increment of motion. When the interpolator completes the processing of a block of data, it is instantaneously reloaded from temporary storage and interpolation continues uninterrupted. Tool motion is continuous.

The circuits of the four-axis machine-control unit are almost exclusively digital in nature. The digital system is of the direct-current level type, using vacuum-tube and diode-gate circuits.

Circle Item 569 on postcard, page 181

Van Norman Versi-Matic Milling Machine

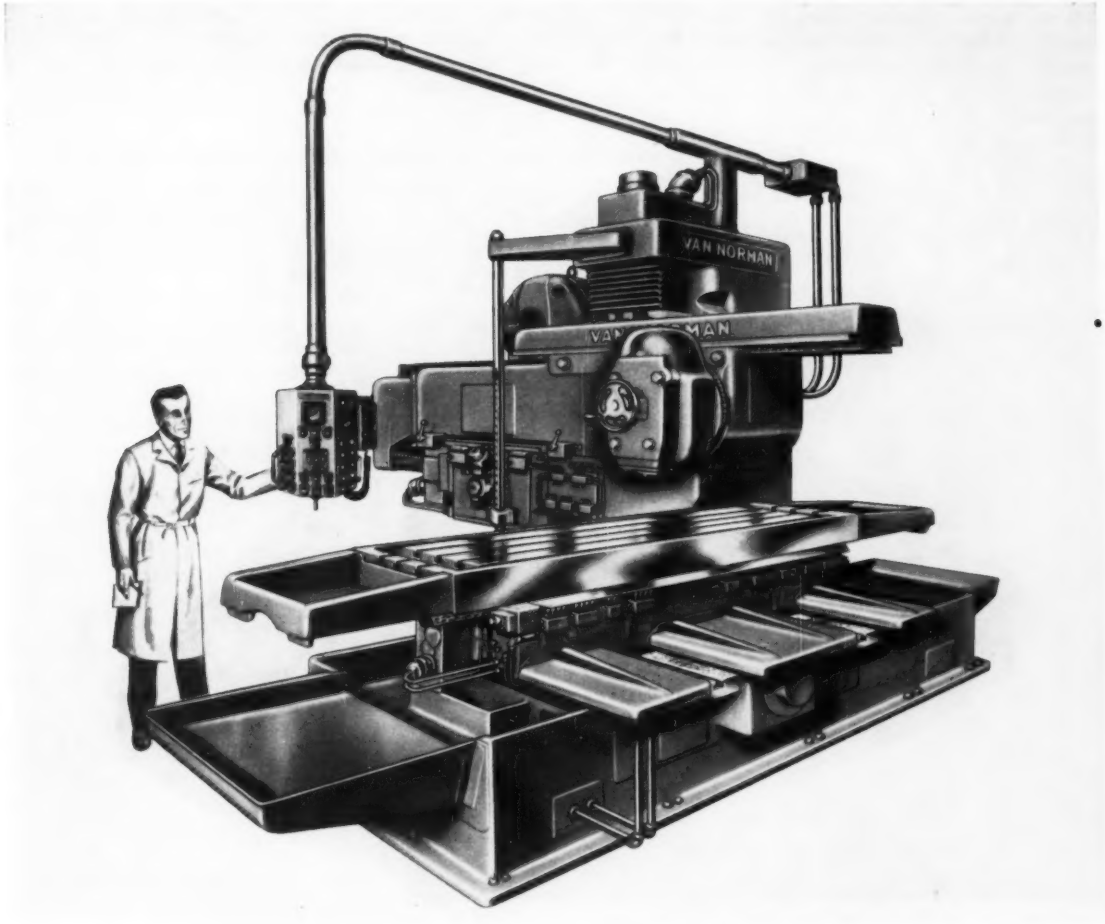
A milling machine designed to cut or shape the newer, tougher superalloys with a high degree of accuracy has been announced by the Van Norman Machine Co., Springfield, Mass. This unit, called the No. 746 Versi-Matic, is especially designed to maintain exacting tolerances on large workpieces. The table is 96 inches long by 24 inches wide. Maximum clearance from the spindle of the swiveling head to the table when the spindle is in horizontal position is 35 inches, and 22 inches when in the vertical position. Either punched or magnetic numerical-control systems can be used.

The Van Norman four-way cutter-head is used on this Versi-Matic to afford the greatest versatility in cutting in all positions, without changing the position of the workpiece. The cutter-head can be used horizontally, vertically, and angularly at any angle up to 30 degrees beyond the vertical position. The machine is available without a saddle, in table lengths up to 130 inches with 30-inch width. All machine feeds are powered by hydraulic motors driving through identical gear-boxes. Large-diameter feed-screws, mounted on preloaded, anti-friction bearings, with recirculating ball nuts, permit accurate response and movement without backlash.

Illuminated, optical vernier scopes and scales make it possible to attain precise positioning. A portable push-button control at each optical-scope station pinpoints on-the-spot readout. Hard, chromium-plated ways with a surface hardness of 70-72 Rockwell C resist wear. The oil-retaining property of these surfaces greatly reduces sliding friction. The ways are lubricated by the latest type of automatic system, designed to assure controlled oil-film thickness. This lubricating feature is of vital importance to precise movement of the machine components.

Horizontal, angular, and vertical milling operations are performed with a minimum of change-over, tooling, and material-handling time. Instant location of the cutter-head in all positions is accomplished with positive stops and vernier readout. The total swivel range is from 0 degrees at horizontal through 90 degrees to 120 degrees. The adjustable pendent and portable control station permit completely efficient operation at any working position.

Circle Item 570 on postcard, page 181

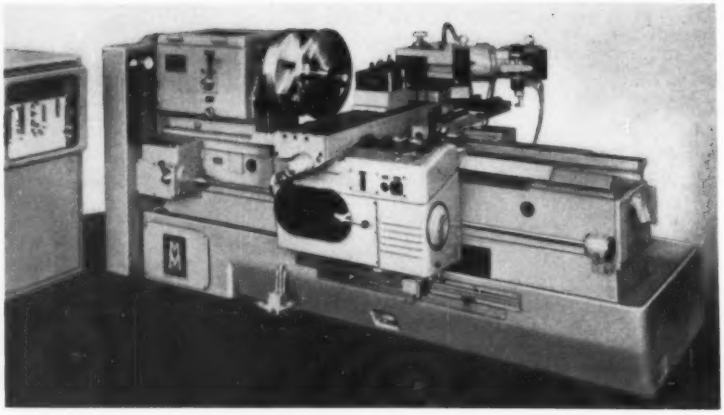


Precision-built Versi-Matic milling machine announced by Van Norman Machine Co.

High-Production Lathe with Automatic-Control System

A Max Mueller high-production lathe with a universal program control, called the "Eltropilot," providing completely automatic machining of a wide variety of work-pieces, is now available in this country from the Cosa Corporation, New York City. The Eltropilot provides pre-set, automatic control of all tool movements on saddle, cross-slide, copy attachments, drilling units, and turret head; all operational functions such as spindle speeds, feeds, feed directions, and rapid traverse; machine loading operations; and actual stopping of the machine.

The key components of the Eltropilot system are a plug panel for accepting and issuing orders, a prepared punch card to indicate correct placement of plugs in panel sockets, and interchangeable trip-dogs set in cam-plates according to desired dimensions. Control orders from the panel are determined by location of the plugs. Impulses transmitted from the plugged panel-socket lines actuate relays which carry out the orders. The punch card is prepared from the standard operation plan, as are the positioning of the trip-dogs in the cam-plates.



Max Mueller high-production lathe with Eltropilot control, available from the Cosa Corporation

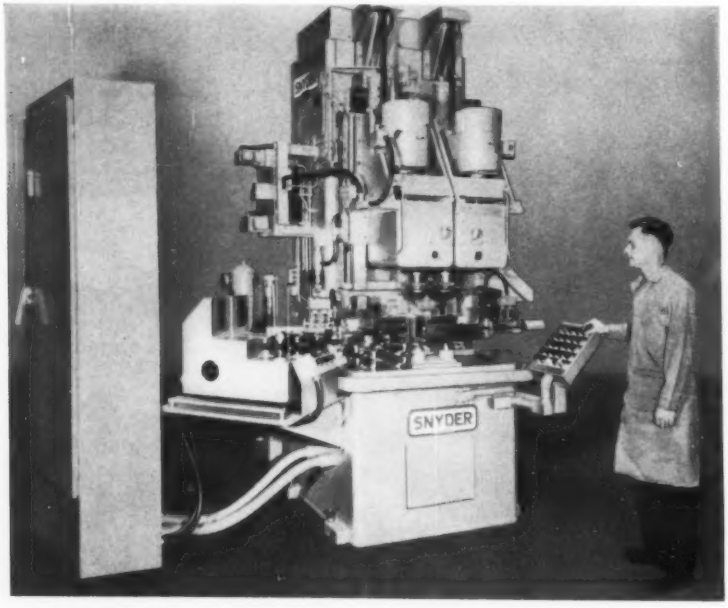
The control can store sixty commands and control twenty operations, with infinite combinations of twenty commands for any operation. Setup is extremely simple. For each new component only the punch chart and trip-dog positions need be changed. Short runs are as economical as long runs. The working cycle can be interrupted at any time and the tools will return automatically to their starting positions. Built-in safety devices check all operations closely.

The Eltropilot system will control all machines having electric motors, electromagnetic clutches, hydromagnetic valves, and similar remotely controllable units.

Circle Item 571 on postcard, page 181

Special Machine for Balance-Milling Connecting-Rods

A special, two-spindle milling machine that hollow-mills both the crank and pin ends on each side of forged-steel, truck-engine connecting-rods to obtain accurate balanced-weight conditions has been built by the Snyder Corporation, Detroit, Mich. This machine produces parts at the rate of 102 pieces per hour. It is an electrically controlled, hydraulically operated type that utilizes a separate hydraulic unit to provide power for feeding the milling spindles, operating wedge feed stops, and clamping the work-piece.



Snyder special two-spindle milling machine for balance-milling both ends of heavy forged connecting-rods

The welded-steel machine base supports a work-holding fixture, a shadowgraph weighing scale with Atcotran controls, and two vertical-way type milling slide units with single-spindle heads. The travel of each slide unit is individually and automatically adjusted by means of wedge stops operated by electrically controlled hydraulic cylinders. The machine is operated by a manual control near the loading station.

A connecting-rod to be processed is placed on the shadowgraph scale which indicates the amount of overweight for each end. Excess weight of the rod simultaneously deflects the scales and

the Atcotran units. Deflection of these units actuates a memory system that initiates travel of both wedge stop cylinders which in turn actuate units. When the Atcotran units of both the scales and the wedge stops reach a balanced condition, a relay causes the travel movement of the cylinders to stop automatically.

With the slide feed stops thus positioned, the Atcotran units are locked out of the weighing system. The operator then removes the rod from the scales and places it in the first position for the hollow-milling of the bosses on the wrist-pin and crank ends on one side. Operation of a push-button control causes the part to be clamped automatically and a milling spindle travel of rapid advance and feed to be initiated. The travel movement of the spindle stops automatically when the slide unit reaches the depth determined by the slide stops. After a short dwell, the slide unit returns to the starting position.

After unclamping, the operator removes the rod, turns it over, and places it in the fixture a second time for the hollow-milling of the crank and pin ends on the opposite side in a similar manner. A red light on the scales lights up to indicate when one part can be removed and another placed on them. Operation of another push-button control causes the balance weight-removal amounts to be transferred to the milling spindles in terms of wedge stop positions.

The machine has a central lubrication system for all sliding and rotating surfaces.

Circle Item 572 on postcard, page 181

Moline Three-Way, Multiple-Spindle Tapping Machine for Processing Transmission Cases

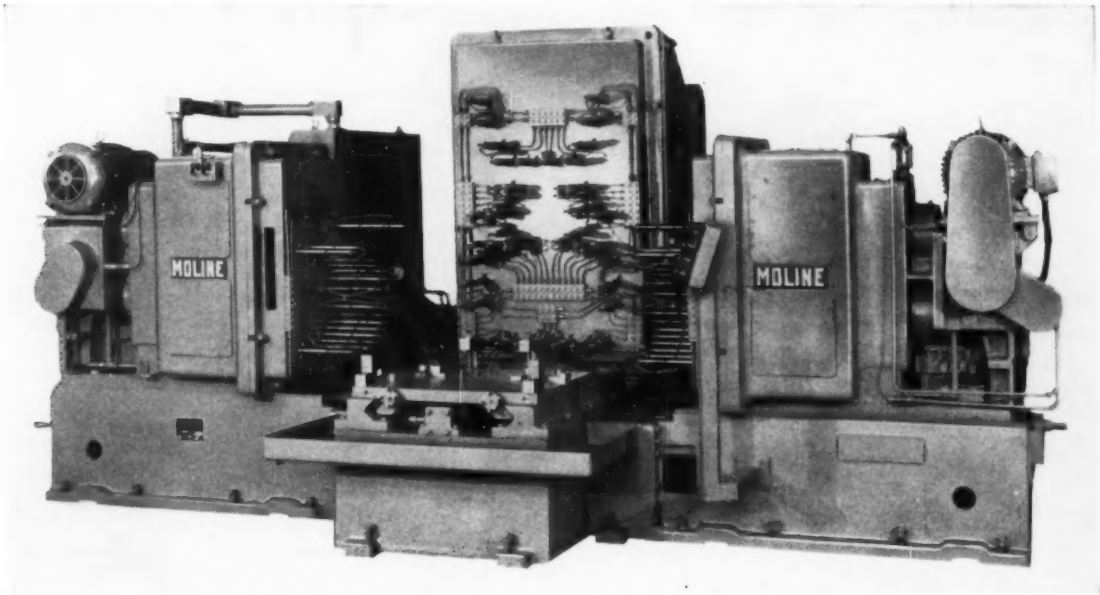
Ninety-three holes in two sides and the rear wall of a tractor transmission case are tapped during each operating cycle of a Model HHU85, three-way, horizontal machine designed and built by the Moline Tool Co., Moline, Ill. The parts to be tapped are held by a simple, manual clamping arrangement on the surface of a hydraulic-actuated work-table. After a transmission case is loaded and clamped, the table is moved to the rear against a positive stop which brings the case into position for tapping. After all ninety-three holes are tapped, and the taps are withdrawn from the work-piece, the table is brought forward by hydraulic power for unloading.

Spindles in each of the three-spindle units are equipped with individual lead-screw feed. Each spindle is driven through universal joints and telescoping drive-shaft, and located in an accurately bored hole in a slip-spindle plate. Thus, it is easy to make new arrangements of spindle center distances, when required, by use of a different slip-spindle plate.

Working area covered by the left- and right-hand spindle units is 18 by 32 inches for each. Each unit has twenty-three spindles. The rear unit covers a working area of 30 by 54 inches and carries forty-seven spindles. Each of the three spindle units is individually adjustable for position nearer to or farther away from the work. All feed travel is by the lead-screws in the individual spindles.

The individual spindles are designed to include protection against trouble from tap breakage, partially plugged drilled holes, and absence of a drilled hole for the tap to enter. A small amount of cutting lubricant is sprayed on each tap automatically just prior to its entry into the work. The horizontal, universal-joint-driven spindle units used on this equipment are adaptable also to vertical mounting or as transfer-machine components.

Circle Item 573 on postcard, page 181



Tapping machine designed and built by Moline Tool Co., for processing transmission cases

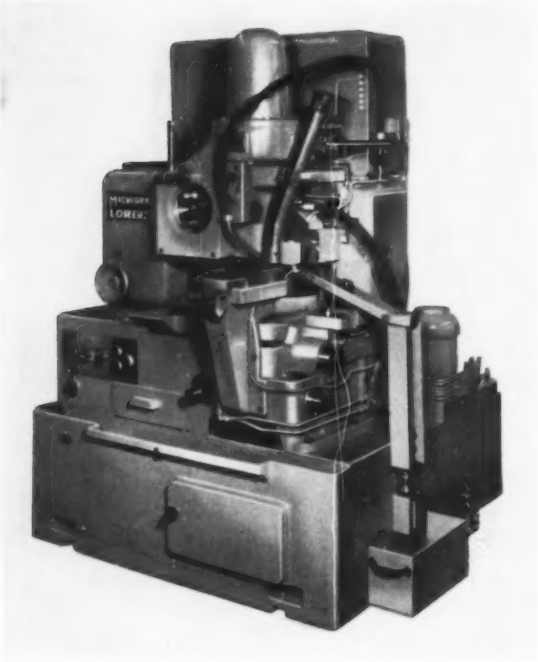


Fig. 1. Michigan-Lorenz Model SV-00 gear shaper introduced by Michigan Tool Co.

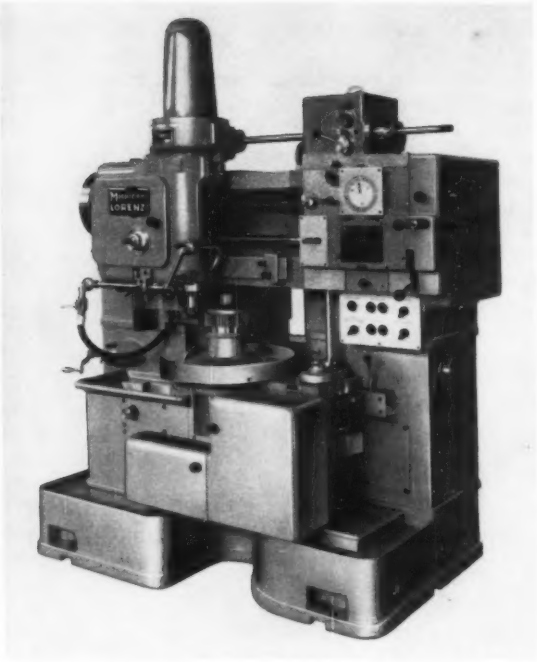


Fig. 2. Model SN-5 semi-automatic gear shaper of the Michigan-Lorenz line

"Michigan-Lorenz" Gear Shapers and Gear-Hobbing Machines

A complete line of gear shapers in seven different models, and two lines of versatile gear-hobbing machines comprising a total of seven models are announced by the Michigan Tool Co., Detroit, Mich. These machines are United States versions, with important modifications, of the Lorenz line produced in Western Germany. All will conform to JIC standards and carry U. S. electrical equipment and controls. They will be marketed and serviced under the name "Michigan-Lorenz" by the Michigan Tool organization in the United States.

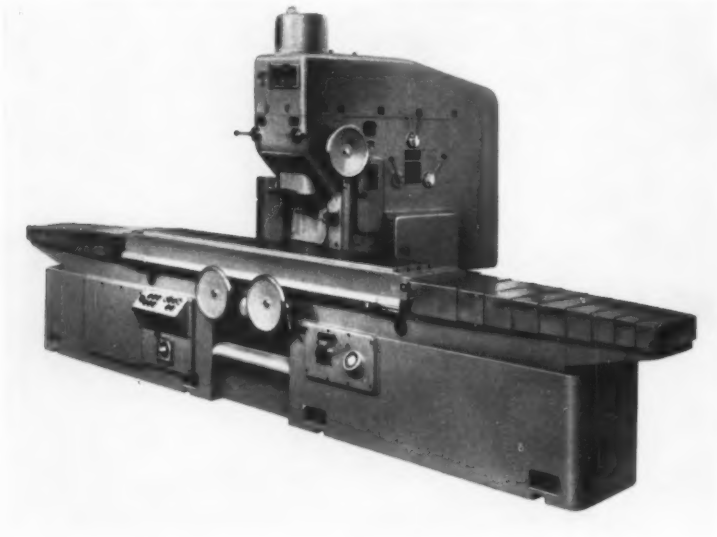


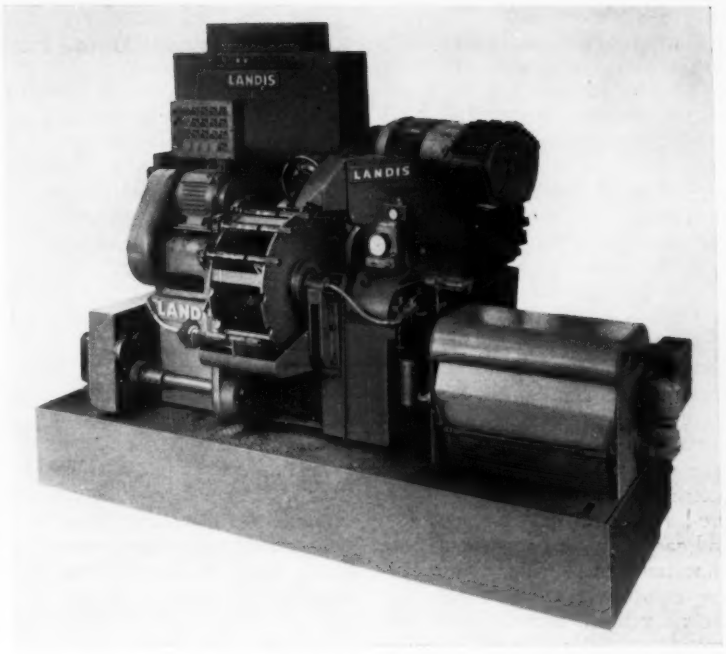
Fig. 3. Model SZA Michigan-Lorenz rack-cutting gear shaper

The standard gear-shaper line comprises four models including the Model SV-00, Fig. 1. This model will handle spur and helical gears up to about 6 pitch. It will cut gears up to 7 inches pitch diameter, using 4-inch diameter cutters, and is equipped with automatic loading and unloading chutes. The Model SN-5 shown in Fig. 2 will handle gears up to about 20 inches in diameter (internals up to 17 1/2 inches). Semi-automatic, it will cut gears up to 3 inches face width on either up or down stroke. "Rough-and-finish" attachments providing automatic increase in speed for finishing are available with this machine. In addition, there are two models designed for shaper cutting of closed-gap type herringbone gears, and a seventh machine, Fig. 3, designed particularly for the cutting of racks up to about 6 feet long. Shorter racks can also be cut on some of the standard gear shapers. The machine shown in Fig. 3 is recommended for cutting racks having

tooth widths up to 6 1/4 inches and up to a maximum of 3 pitch.

The two series of hobbers are designed primarily for versatility and accuracy and thus complement Michigan Tool's line of high-production hobbers. The machines essentially are of the heavy-duty type, one series for medium-size gears and another for large sizes. The Model E-12, Fig. 4, will hob gears up to 4 feet in diameter and up to 2 pitch. A Model E-9, not shown, is for gears up to 35 1/2-inch diameter and pitches up to 3. A medium-size hobber, Model E-30, takes gears up to about 10 feet in diameter. Accuracy, versatility, and rigidity are outstanding features of these hobbing machines. Indicative of the accuracy of the Michigan-Lorenz hobbers is a setup for checking the cutting of a Cone-Drive double-enveloping worm-gear on an E-9 hobber. On this machine the accumulated tooth-spacing errors checked out to a maximum of only fourteen seconds. All of the gear hobbers are vertical, single-spindle types, ruggedly built to meet present-day demands for accuracy, and with a versatility which makes them especially well adapted for either fairly large or job-lot runs. All of the models are available with or without automatic loading and unloading facilities.

Circle Item 574 on postcard, page 181



Landis plunge type, cylindrical production grinder equipped with automatic rotary work loader

Automatic Plunge Type, Cylindrical Production Grinder

A plunge type grinding machine equipped for automatic loading, unloading, and completely automatic cycling, including in-process sizing, has been developed by the Landis Tool Co., Waynesboro, Pa. This machine grinds, simultaneously, three different diameters and the flange face of a transmission output shaft.

Stock to a depth of 0.025 inch is removed from each diameter and the face surface is given a 20- to 25-micro-inch finish by removing 0.015 inch of stock. Production is about 105 shafts per hour. The grinding wheel-head is set at a 30-degree angle, and properly spaced grinding wheels are mounted on the right-hand end of the spindle. The machine is equipped with a combination magnetic and fabric filter unit for the coolant.

The design of this machine makes it possible to use an automatic, rotary type loader as shown in the illustration, or a chute type loader for handling the workpieces. Hand-loading can also be used. Coolant and hydraulic oil reservoirs, as well as all hydraulic control valves, are mounted away from the bed to minimize the possibility of heat from the units affecting machine alignments and to make them readily accessible. An outstanding feature of the Landis "Microfeed" wheel-feed system introduced on this machine is its ability to produce accurate dupli-

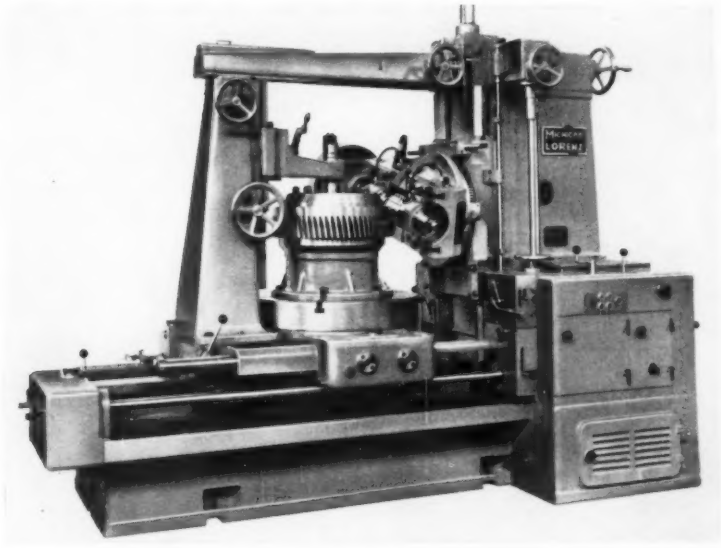


Fig. 4. Michigan-Lorenz Model E-12 gear-hobbing machine

cate work continuously. This system will feed the grinding wheel in increments as small as 50 millionths of an inch. Another extremely important feature is that the feed always resets the same amount from the finish size on each cycle regardless of the amount of fine feed previously required to bring the work-piece to its final size. With each grind cycle all elements of the feed are automatically set in relation to the on-size position of the piece just ground. This automatically compensates for all the variables which are present in precision grinder feed systems.

The grinding wheel (or wheels) is dressed by the Landis R type dresser. This unit is mounted on pre-loaded steel balls for accuracy and easy traversing movement. An important time-saving feature of the equipment is its ability to dress a profiled wheel in both directions at angles up to 60 degrees. The dresser can be tied into the grinding cycle to dress the wheel automatically after a predetermined number of pieces have been ground. A compensating feed for the wheel feed automatically compensates for wheel-diameter reduction due to dressing.

Circle Item 575 on postcard, page 181

Sundstrand-Packmaster That Forms a Continuous Belt of Thermoplastic Dome Packages Containing Small Parts

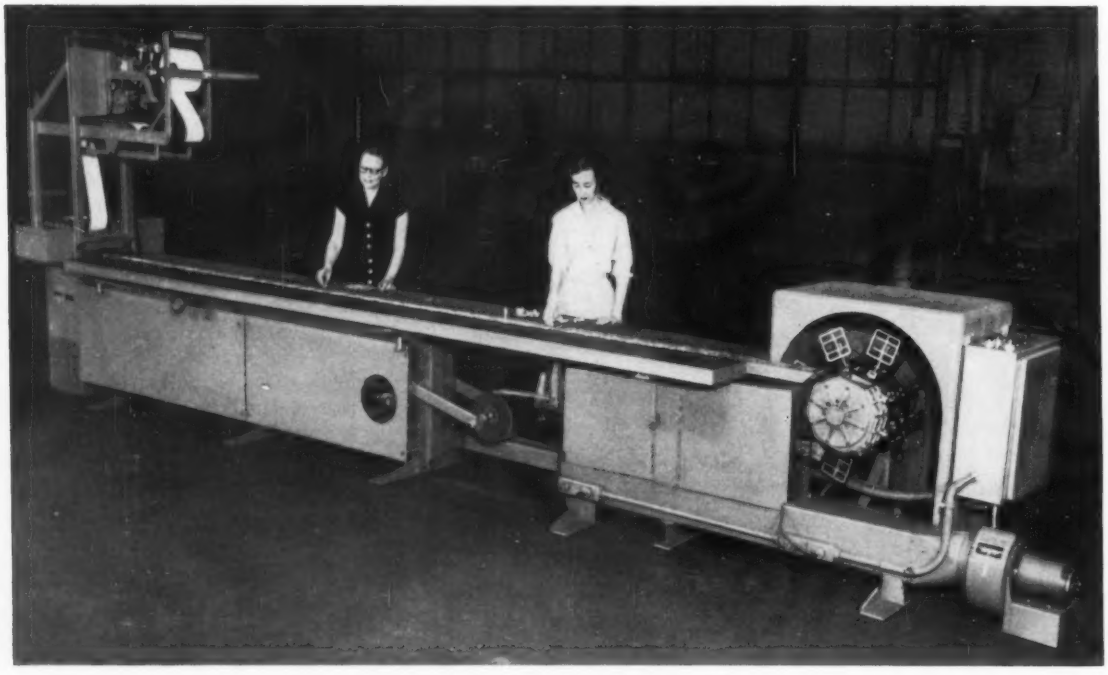
Thermoformed packages—known variously as "blister," "bubble," or "dome-pack"—can be formed in a wide range of sizes and shapes on a Sundstrand-Packmaster Model 58 packaging machine announced by Sundstrand-American Broach, Division of Sundstrand Machine Tool Co., Ann Arbor, Mich. In addition to providing outstanding flexibility, the machine attains a high production rate. Packages measuring 4 by 4 inches are produced at the rate of 60 per minute. Production of smaller packages is at a higher rate.

Thermoformed "bubbles" become their own conveyor as they move through the machine. These vacuum-formed packages use the flange base produced during the forming operation to support the package and parts as both ride on the guide rails of the loading table during the packaging operation. A handwheel calibrated for width setting provides simple adjustment for a broad range of package widths. Table lengths depend entirely on the product or product package and the number of operators or automatic loaders used.

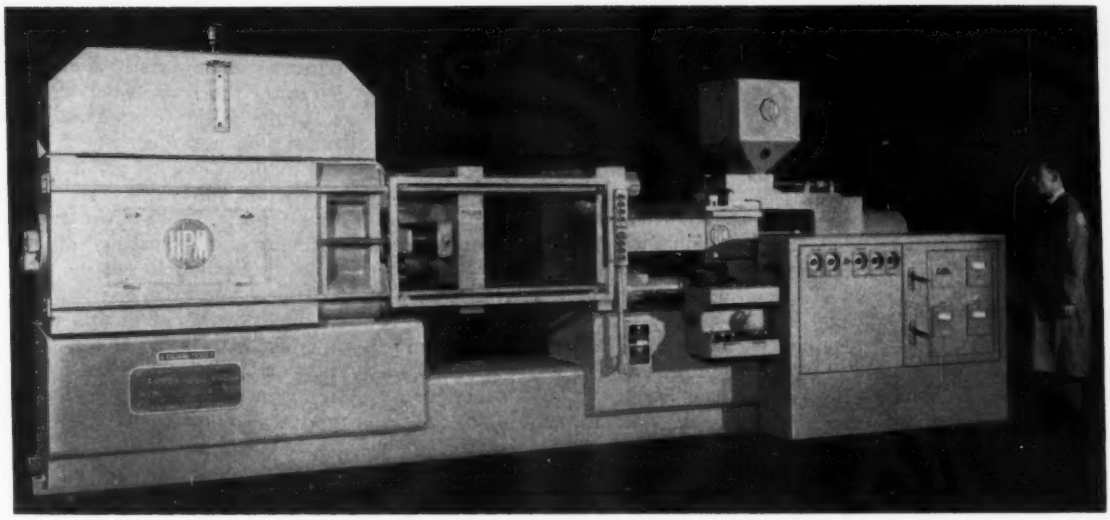
In vacuum-forming the thermoplastic dome package itself, the film material comes from a roll mounted at the center of the machine base. It is drawn through a series of heat lamps before passing between the roll and drum located at the entry end of the machine. Here it is heated to approximately 300 degrees F., clamped in a station on the revolving drum, and drawn to shape. This is done by applying vacuum to draw the thermoplastic material into the mold or form. As the drum continues to revolve, clamps are automatically opened and the strip is released to continue through the machine. Here, parts are placed into each formed bubble by operators or automatic loaders.

The forming dies are so designed that trade-marks, crests, or similar identification features can be added to the form required by the product being packaged. To seal the package, either clear or opaque thermoplastic sheets or a kraft type heat-seal may be used, depending on the product. Packages leaving the line can be cut off individually or run in a continuous ribbon.

Circle Item 576 on postcard, page 181



Sundstrand-Packmaster packaging machine



Plastics injection molding machine brought out by Hydraulic Press Mfg. Co.

High-Speed Plastics Injection Molding Machine

A 12- to 16-ounce plastics injection molding machine capable of extremely high operating speed is announced by the Hydraulic Press Mfg. Co., a division of Koehring Co., Mount Gilead, Ohio. It is possible to operate this Model 350-HV-12/16 unit at a speed of 600 cycles per hour at full clamp stroke and maximum tonnage. With a reduced stroke, speeds up to 1000 cycles per hour can be attained.

This 350-ton equipment, with a 60-hp system, features a full hydraulic clamp with 22-inch stroke and 34-inch daylight capacity (42-inch daylight with ejector box removed). Large 34- by 34-inch platens provide space for mounting mold bases up to 20 by 34 inches, either vertically or horizontally. The 20 1/2-inch space between the tie-rods and the large area below the die space allows plenty of room for automatic drop-out of parts. The knockout bar exerts a pressure of 20 tons and has a stroke of 4 inches. This bar can be easily moved for either a horizontal or vertical knockout pattern. Automatic clamp slowdown is provided prior to bar contact to prevent damage to ejected parts.

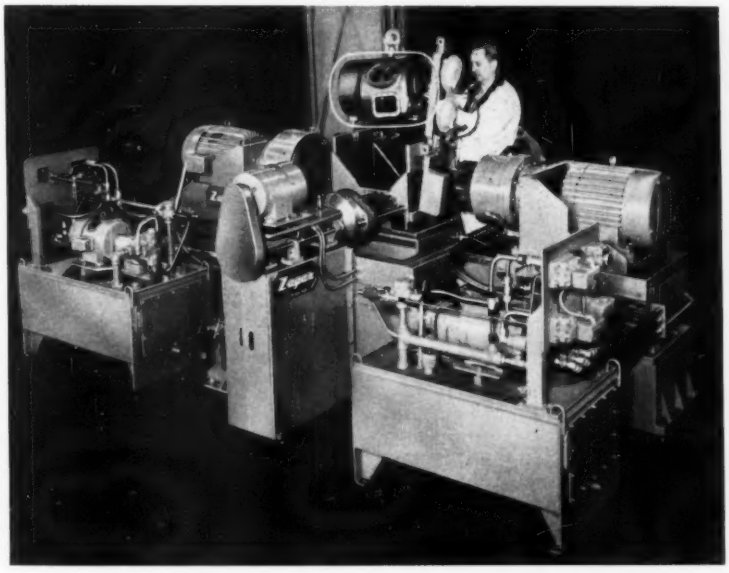
The clamp automatically adjusts itself for different mold thicknesses, thus cutting mold setup time to a minimum. Any part of the total ram stroke can be used. Clamp controls are centralized. Easily adjusted limit switches provide adjustment for stroke, daylight, slow-close for die contact, slow break-away, and ejection stroke. All hydraulic and electrical components are mounted in the open, at floor-level working height.

Circle Item 577 on postcard, page 181

Machine Designed to Drill Casting from Four Sides

Zagar, Inc., Cleveland, Ohio, is introducing a machine equipped with 20-hp feed units. A unique feature of this machine is the arrangement that permits three drill patterns to be drilled by each of four drill heads. The changeable patterns are made by removal of the non-operating drills when casting and fixture are changed from one job to another. The drill heads are located in the form of a cross, the casting being drilled from four sides simultaneously. This machine drills a total of 108 holes.

Circle Item 578 on postcard, page 181



Zagar machine developed to drill four sides of casting simultaneously

Lepel Induction Heating Equipment

The addition of a dual-frequency generator and a floating-zone fixture for metal refining to its line of high-frequency induction heating units has been announced by the Lepel High Frequency Laboratories, Inc., Woodside, N. Y. The dual-frequency generator, Fig. 1, is rated at 10 kilowatts of output power. The lower frequency range is 250 to 600 kilocycles. The higher frequency range is approximately 2 to 5 megacycles. It provides flexibility in heating operations where it is important to make changes in frequency without changing the basic features of the standard generator. The dual-frequency feature also eliminates the necessity of purchasing two separate generators. Megacycle frequencies are ideal for heating very thin parts and semiconductor materials.

The megacycle circuit components are located in the lower portion of the cabinet and the standard frequency tank circuit components are housed in the smaller cabinet on the top. Both circuits use the same oscillator tube and direct-current power supply. Each tank circuit has a separate grid control, permitting proper adjustment for grid requirements. For experimental work, the megacycle frequency range can be altered by using capacitors of different values in the tank circuit.

The Lepel Model HCP floating-zone fixture, Fig. 2, is designed for the production of ultra-high-purity metals and semiconductor materials. Purification or crystal growing is achieved by traversing a narrow molten zone along the length of the process bar while it is being supported vertically in vacuum or inert gas.

Although designed primarily for production purposes, the unit shown in Fig. 2 also provides great flexibility for laboratory studies. Features include a smooth, positive, mechanical drive system with continuously variable up, down, and rotational speeds, all independently controlled. There is also an arrangement to rapidly center the process bar in a straight-walled quartz tube supported between gas-tight, water-cooled end plates. Placement of the quartz tube is simple. Adapters can be employed to accommodate large-diameter tubes for larger process bars.

Circle Item 579 on postcard, page 181

Fig. 1. Lepel dual-frequency generator for heating purposes

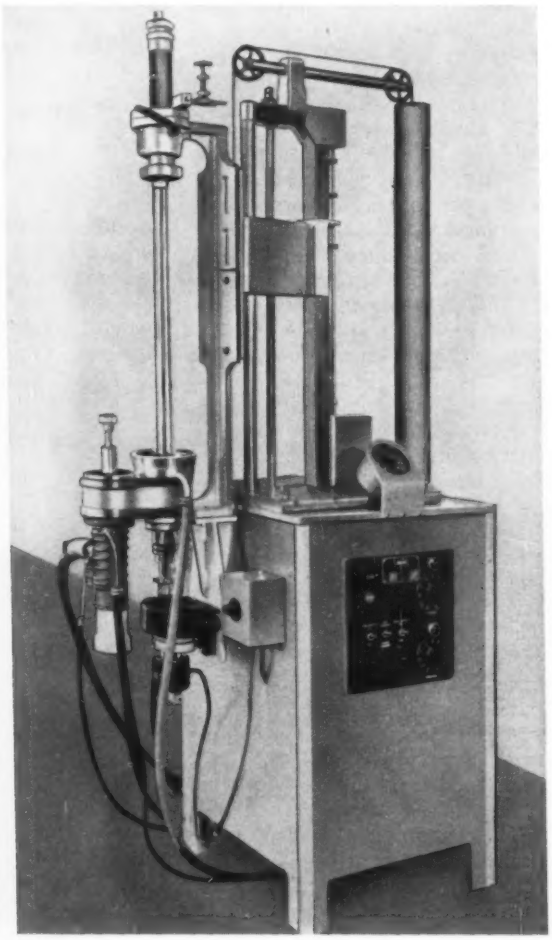


Fig. 2. Lepel unit for metal refining and crystal growing

Four-Column Single-Action Hydraulic Press

Four-column, single-action, hydraulic presses built by K. R. Wilson, Inc., Arcade, N. Y., have been modernized and expanded. Built in forty-eight standard models, either up-acting or down-acting, the line now covers a range of 25 through 1000 tons. With a frame construction that permits access to the working area from all sides, presses can be fed from the front, back, or either side. Of rugged, welded-steel construction, the crown, bed, and sliding platen provide maximum resistance to deflection. Align-bored to automatically controlled tolerances, the sliding platen is guided on ground and polished columns which are closely fitted into the crown and bed.

The easily adjusted hydraulic systems of these presses are designed to be fully responsive to all controls. The pumping unit can be mounted at the top of the press or furnished for floor installation. All models can be outfitted with manual, lever, or electric push-button controls for single or continuous cycling. Die cushions, and steam or electrically heated platens, as well as other accessories, are available.

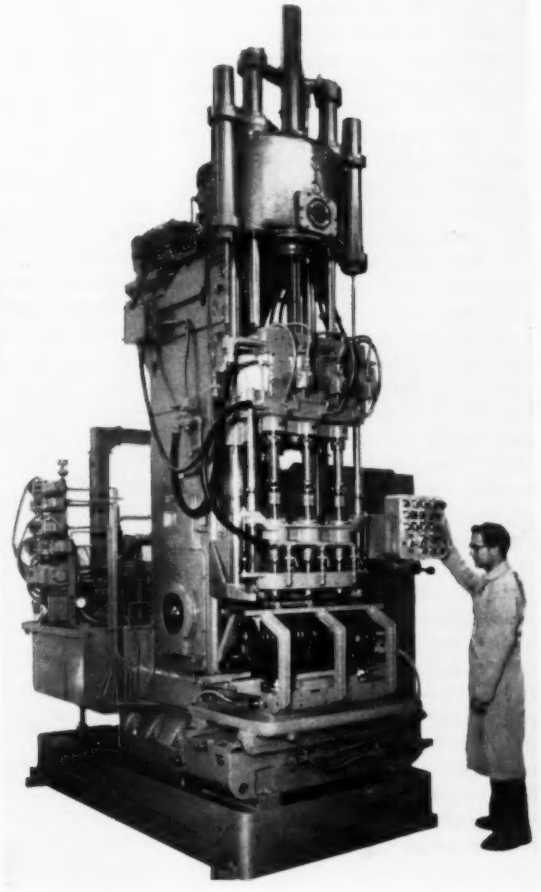
Circle Item 580 on postcard, page 181

BarnsdriL Multiple-Spindle Honing Machine

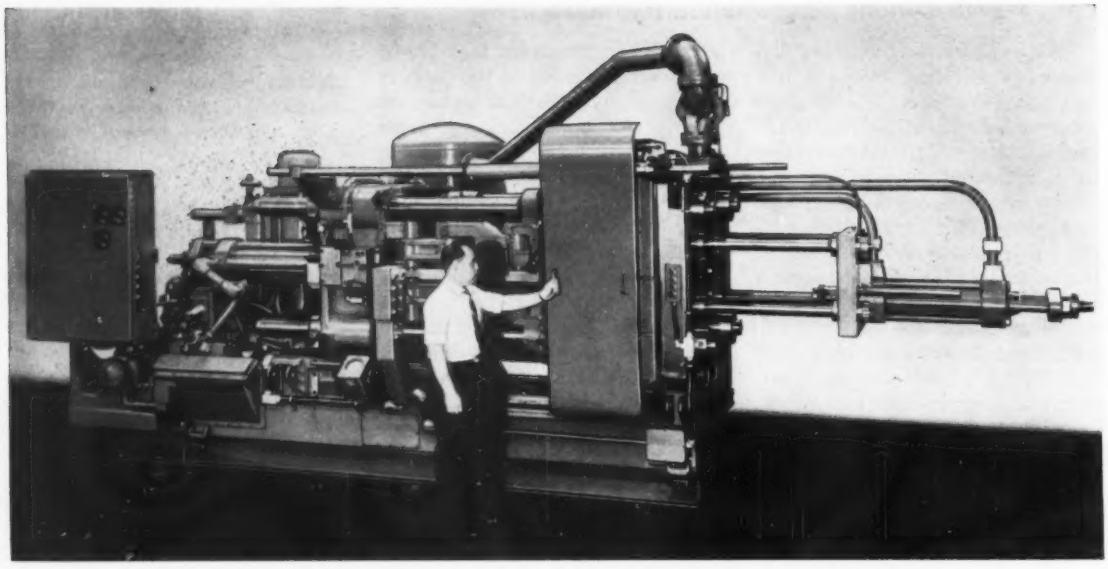
The Barnes Drill Co., Rockford, Ill., recently completed and delivered its first Model No. 4014 three-spindle, vertical type honing machine. The unit is equipped for individually controlled pneumatic hone feed for each spindle. Improved design allows hone-feed pressure calibration to compensate for varying operating conditions caused by bore-size irregularities and different degrees of stock hardness. The result is shorter cycle time, improved bore conditions, and reduced stone wear. With this system it is said to be possible to use coarser stones for faster stock removal and still hold the work within a closer micro-finish tolerance range.

An automatic feed cleanup timer is actuated when all three bores are sized out and the tools have collapsed, yet continue to rotate. The tools expand simultaneously under constant low pressure to contact the walls of the bore. The timer gives a predetermined number of strokes to obtain the desired surface finish. From three to five

K. R. Wilson four-column, down-acting, hydraulic press available in recently expanded line



Three-spindle honing machine for processing cast-iron cylinder blocks built by the Barnes Drill Co.



Six-hundred-ton die-casting machine manufactured by Reed-Prentice Division, Package Machinery Co.

extra strokes are generally needed to apply the required finish. Approximately 0.003 inch of stock is removed from the fine-bored cylinder walls of the six-cylinder cast-iron blocks honed on this machine. The three-spindle auxiliary head requires only one index to complete the honing of the part.

The operator slides the block to be honed into the tunnel type fixture from a supply conveyor at the left of the machine. With the leading edge of the block against a positive stop, the block is clamped hydraulically by pressing the clamp button on the control panel. Pressing the start-cycle button will initiate machine motions for honing three bores, and for indexing and honing the remaining three bores without operator attendance. The operator presses the unclamp button with the fixture in the right position and slides the block out of the fixture to the right on the discharge conveyor. The left index button is pressed to index the fixture to the loading position. The production rate is thirty-two blocks per hour at 80 per cent efficiency, and finish is maintained at 25 to 35 micro-inches. The machine is equipped for a 25-inch hydraulic spindle stroke and has Plugmatic bore equipment for bore sizing. Two 15-hp motors drive the hydraulic system and the spindle.

Circle Item 581 on postcard, page 181

Reed-Prentice Die-Casting Machine

A 600-ton die-casting machine manufactured by Reed-Prentice Division of Package Machinery Co., East Longmeadow, Mass., is designed for all types of cold-chamber die - casting. Hand ladling, automatic ladling, or automatic feeding through the Reed "Vacufeed" system can be utilized. The Vacufeed method combines automatic feeding with vacuum die-casting, attaining speeds equal to those used in zinc die-casting.

Aluminum die-castings weighing up to 10 pounds can be produced on this 600TDA unit which has an adjustable die stroke of 12 1/2 to 18 1/2 inches. Die-plates measure 47 by 46 1/2 inches and give 28 1/2- by 28 1/2-inch clearance between tie-bars. Strain-gage-tested die-locking pressure is 600 tons. One retained, graduated tie-bar nut accomplishes adjustment of the 5 1/2-inch diameter tie-bars. The tie-bars may be pulled or moved forward by hydraulic power using a cam type way-locking device.

The shot cylinder on the machine is provided with an adjustable slow start to allow complete venting of the sleeve and runner system. To accommodate sleeves of different length, the shot-cylinder stroke is adjustable in a 6-inch range of initial phase of stroke, making the complete stroke adjustable from 14 to 20 inches.

The hydraulic system employs three pumps: (1) a low-pressure (1000 psi) low-volume pump for bottle recharging, (2) a low-pressure (1000 psi) high-pressure pump for fast closing and opening of die-plates and plunger return, and (3) a high-pressure (2000 psi) low-volume pump for final die closing and intensified metal squeeze. All three pumps deliver 1000 psi when required for fast operation.

Circle Item 582 on postcard, page 181

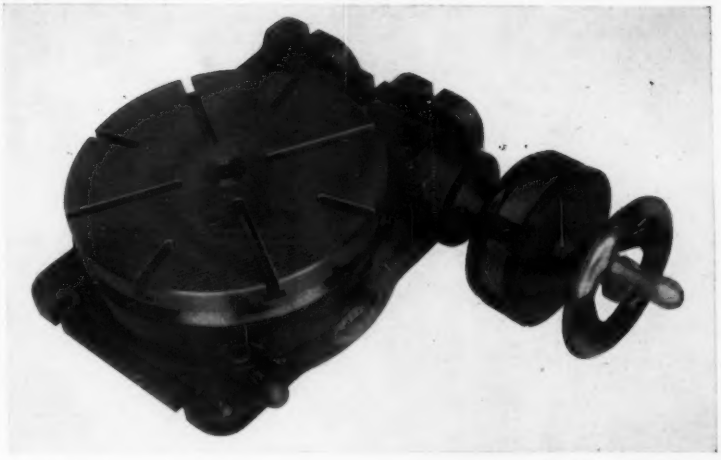
Moore "Ultra-Precise" Rotary Table

An "Ultra-Precise" 11-inch rotary table, which reads to 1 second of arc and has an over-all performance accuracy of plus or minus 2 seconds throughout the entire 360-degree circle, is being introduced by Moore Special Tool Co., Inc., Bridgeport, Conn. The company also offers a rotary table which reads to 5 seconds of arc and has an over-all accuracy of plus or minus 6 seconds. The "Ultra-Precise" rotary table was developed to meet the demand for more precise angular spacing. This is achieved through the use of a non-disengageable, ground worm

in combination with the accurately spaced teeth of its mating gear.

A unique, corrective lapping technique which produces the precise tooth spacing is done by an ultra-sensitive method of angular measurement—interferometric inspection and calibration. The interferometer employed for this purpose is accurate to 1/10 second of arc and uses interference bands of monochromatic light as a means of angular measurement. Periodic and lead errors of the worm are also corrected to within less than plus or minus 1/4 second. As a final operation to assure precise angular spacing, the worm and gear are burnished together to glaze and work-harden their perfectly matched contact surfaces.

The hand-scraped, steel table top is parallel with the base within less than 0.0001 inch. The conical surface below the T-slots is graduated in degrees as an easy-to-read reference scale. Fine setting is read to 1 second on chromium-plated dial and vernier. The center bushing hole runs true to 0.00015 inch. The table can be used in conjunction with its companion unit, the new Model No. 2 sine plate, to obtain compound angle settings. Maximum work-height capacity on either sine plate or rotary table results from separation of these units.

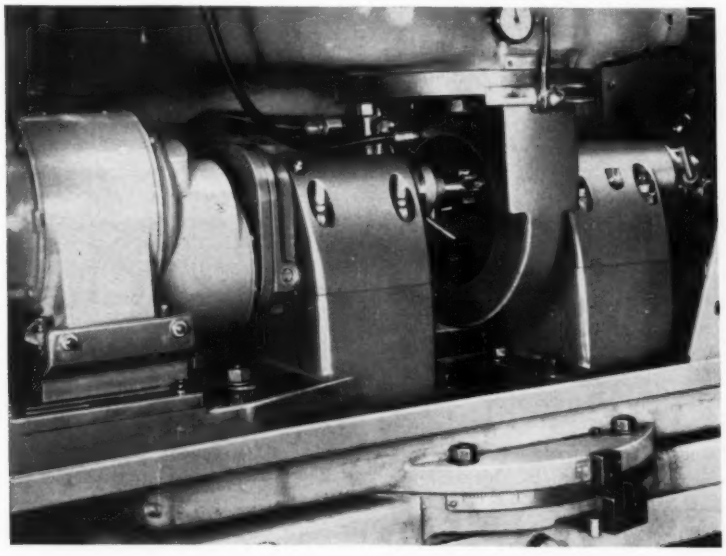


"Ultra-Precise" rotary table announced by Moore Special Tool Co., Inc.

Circle Item 583 on postcard, page 181

Gear-Shaving Process for Precision Gears with Twelve or Less than Twelve Teeth

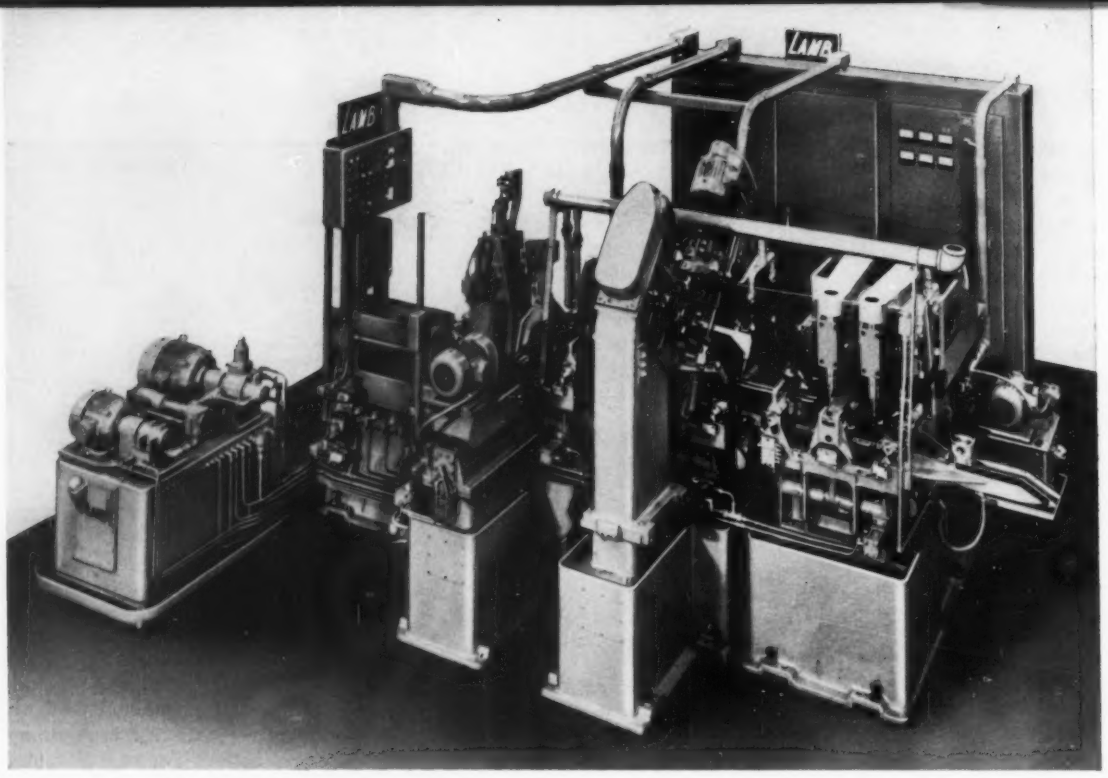
Engineers of the National Broach & Machine Co., Detroit, Mich., have developed a Red Ring rotary gear-shaving process that provides accurate control of surface finish, profile, and lead on gears having twelve or less than twelve teeth. This patented process is said to give accuracies not previously obtained with conventional methods utilizing external-gear type rotary shaving cutters. An unsual rotary gear-shaving cutter made in the form of an internal helical gear is used. This arrangement provides increased surface contact between the cutter and work-gear profiles due to the enveloping action of the cutter. As a result, the cutter is able to produce smoother, more accurate tooth profiles on work gears having small numbers of teeth than is possible with the usual method where essentially two external gears (one a gear, the other a cutter) are meshed in crossed-axes relationship.



Setup on Red Ring rotary gear-shaving machine for finishing eight-tooth gear

The new process requires the application of a different drive arrangement to the shaving machine. On conventional rotary gear-shaving machines, the cutter drives the work. For the new process, utilizing an internal helical-gear type cutter, the work gear drives the cutter. The hardened-and-ground high-speed steel shaving cutter is mounted in a special head on a conventional Red Ring shaving machine. This head has a sleeve type bronze bushing that supports the shaving cutter, which is free to rotate. The cutter center line is set in accurate crossed-axes relationship with the work-gear center line by a vernier on its mounting head.

The work gear, which can be supported at each end for the shaving operation, is driven by a gear-head motor mounted on a platform integral with the headstock cast-



Automotive piston-processing machine built by F. Jos. Lamb Co. which has a production rate of 400 pieces per hour

ing. An additional gear reduction is provided between the motor and work-gear drive-shaft.

To carry out the new process, a work gear is mounted in the headstock (with either centers or some other type of driving arrangement) in mesh with the cutter. The tailstock center is advanced to the work and locked. Then the shaving cycle is initiated by a push-button control. The work gear is rotated while being traversed back and forth in mesh with the cutter. It is then fed upward either manually or by an automatic differential up-feed mechanism until proper tooth size is reached. At the end of the cycle, the work is unloaded to complete the shaving operation. The setup illustrated is for finishing an eight-tooth, 4-pitch, 30-degree pressure-angle pump gear on a Red Ring rotary gear-shaving machine.

Circle Item 584 on postcard, page 181

Ten-Station Automatic Machine Designed to Process Pistons of Three Different Sizes

High production and the flexibility required to handle three different sizes of work are features of a ten-station, automotive piston-processing machine designed and built by F. Jos. Lamb Co., Detroit, Mich. This unit processes 400 parts per hour and is arranged so that equipment for additional operations can be applied between any of the three main sections of the machine. It also performs the following functions: loading, orienting, rough-boring of the wrist-pin holes, drilling of angular oil holes in wrist-pin bores, probing of drilled holes, and sawing of smoke slots.

Operation of the machine is completely automatic. Parts are chute-fed downward to the loading station from where they are transferred to the orienting station. An orienting head rotates the parts 180 degrees into alignment.

The drilling units are the builder's standard self-contained, hydraulic quill units. Boring and sawing spindles are carried on hydraulic slides. The sawing spindles have micro adjustments to permit fast change-over for different-size pistons. Ammeters, mounted in the door of the electrical panel, show motor loads and indicate dull tools. A schematic light panel, above the operator's push-button panel, shows location of machine function or malfunction. A central lubrication system and manifold-mounted hydraulic components are other features. All hydraulic and electric components conform to JIC standards.

Circle Item 585 on postcard, page 181

Lincoln Machine for Manual Inert-Gas Welding

The Lincoln Electric Co., Cleveland, Ohio, has announced a new "Idealarc" welder for tungsten inert-gas welding. This machine also can be used for conventional metallic arc welding. It is said to

"Idealarc" inert-gas welding machine

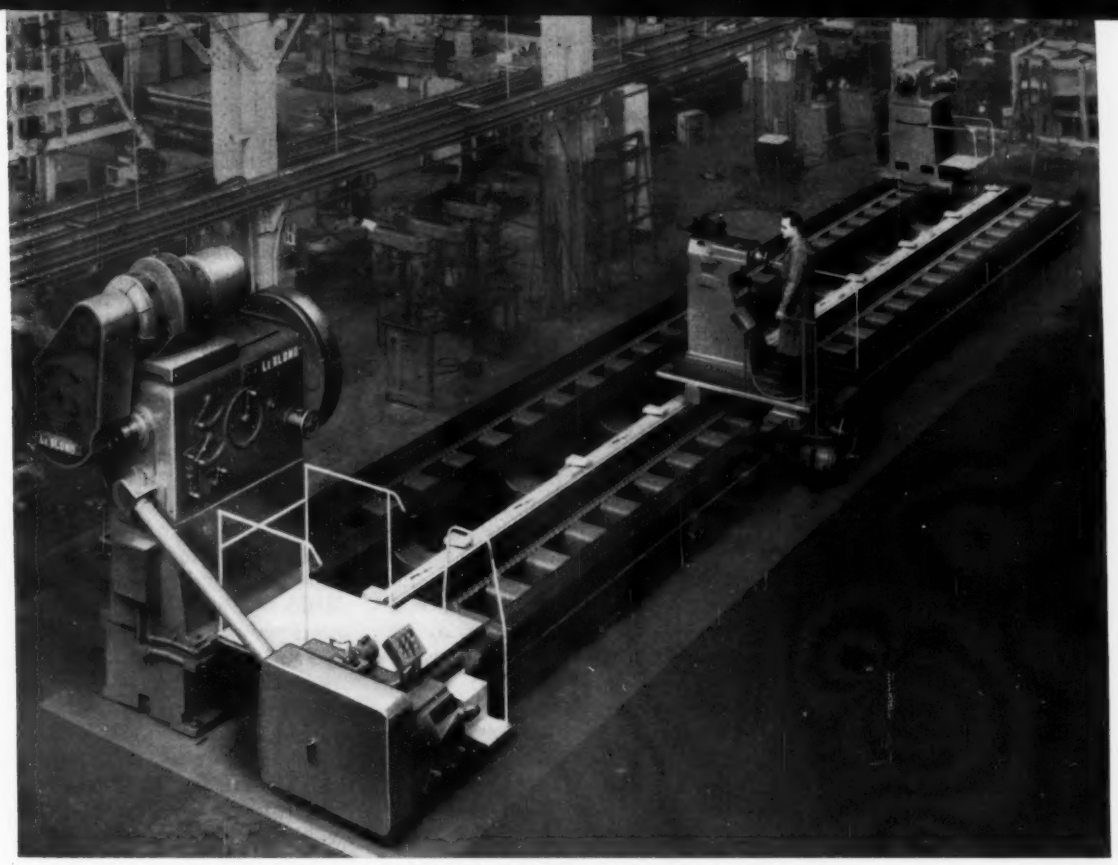


Fig. 1. LeBlond "Admiral" lathe of giant size built to handle rocket work

have many optional features that permit the manufacturer to provide machines "tailor-made" to the user's requirements at a price consistent with volume production.

The Tig model Idealarc is available in the NEMA-rated 300-ampere size, either as a straight alternating-current transformer welder or as a combination alternating- and direct-current rectifier welder. Either type has a saturable reactor type control.

Optional features that may be added to either type of welder include a high-frequency kit complete with controls for water, gas, and high-frequency arc intensity; remote hand or foot control for adjusting amperage to fill craters or compensate for variations in the joint; a filter to eliminate direct current created in the arc when welding with alternating current and high frequency; a line contactor (starter) with overload protection and either line—or 115-volt push-button; and power-factor-correction condensers. Users are free to select and buy only the features required for their specific applications.

Circle Item 586 on postcard, page 181

Huge "Admiral" Lathe Built by LeBlond for Rocket Plant

A "space age" lathe so large that only three railroad cars in the country can handle it has been shipped by the R. K. LeBlond Machine Tool Co., Cincinnati, Ohio, to Aerojet-General, Inc., Azusa, Calif. Where ordinary lathes have only one bed, this giant-size machine has two side by side. It weighs in excess of 57 tons, is 54 feet 6 inches long and 120 inches wide. Although its equipment includes a 47-inch faceplate, the double bed gives the lathe a clear swing of 105 inches over the platen.

This machine, called the "Admiral," can be used for metal turning, but has other applications as well. It can handle a work-piece 45 feet long and 105 inches in diameter. Its spindle bearings will take a 50,000-lb. line load. In the rocket industry the work-pieces are likely to be large but light. Those

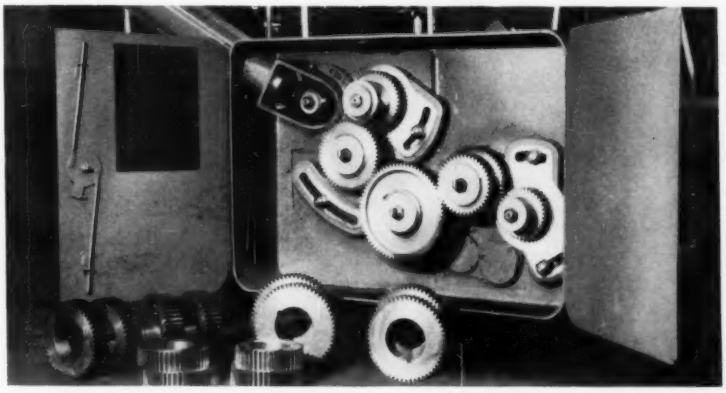


Fig. 2. Close-up of special gears for multiple threading with lead changes in increments of 0.020 inch on lathe shown in Fig. 1

processed on this lathe will probably be no exception, since the lathe is equipped with only a 50-hp variable-speed motor.

Features include a full range of speeds from 1 to 110 rpm and feeds as low as 0.01 inch per revolution. The spindle is equipped with an electric brake for quick stops. Leads can be varied in microscopic steps. To minimize operator fatigue, most of the controls have been concentrated on the front of the lathe carriage, including remote controls for the headstock. The operator rides on the lathe carriage.

Circle Item 587 on postcard, page 181

Morris Unit Type Tapping Machine

An automatic unit type tapping machine, designated Model 409-S, is now being manufactured by the Morris Machine Tool Co., Cincinnati, Ohio. This four-spindle machine is designed to process 1/2-inch electrical-conduit lock-nuts. It selects, positions, loads, taps, and ejects 1215 pieces per hour at 80 per cent efficiency. Units are also available for 3/4-, 1-, 1 1/4-, 1 1/2-, and 2-inch size lock-nuts. The machine consists of a vertically mounted four-spindle individual lead-screw tapping unit, two motorized hoppers and feed mechanisms, and four fixtures, all mounted on a common cast-iron base with a platen surface machined on the top face. These components are lubricated automatically by an oil-mist system.

The fixtures are fed by four tracks, two originating from each hopper, and are automatically operated. Parts are oriented so that they arrive with the concave side down. This assures that any burr left on the tapped parts will be on the concave side. The parts or lock-nuts are transferred to the work-holding fixtures by an air-operated shuttle mechanism. As the parts enter the fixture, cog-like guide rails orient them on their lugs for proper positioning. The parts are secured in position by an air-operated, equalized clamping mechanism which is actuated electrically when the shuttle has correctly positioned the work. Equipment features a 15-hp motor having a speed of 1200 rpm.

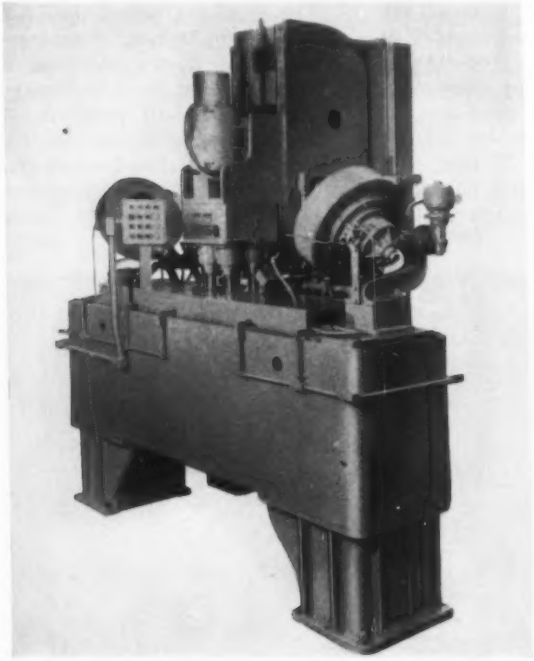
Circle Item 588 on postcard, page 181

Austin Universal Grinder

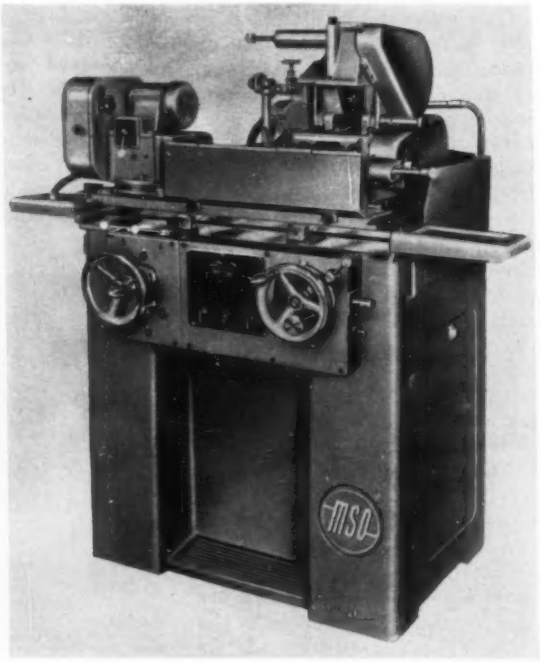
The Austin Industrial Corporation, White Plains, N. Y., United States distributors for the MSO Works, West Germany, has announced introduction of an MSO Model FMES 7- by 12-inch universal grinder. This model is one of a complete line of precision grinding machines built by the MSO Works. It has a wheel-head mounted on a compound swivel-base for grinding steep tapers; a 90-degree swiveling work-head for face grinding; and a live- and dead-center work-spindle. There is a dual-speed hand table traverse for shoulder grinding and a three-speed power table traverse.

Manual and automatic wheel-head infeed and fine infeed to 0.00004 inch on work diameter are available. The table swivels 10 degrees in or out. The internal grinding attachment is of the hinged type. Other features include patented adjustable spindle bearings with force-feed lubrication and vibration-free gearless drive from dynamically balanced motors. The grinder is also available with hand table traverse and manual wheel-head infeed only.

Circle Item 589 on postcard, page 181



Unit type machine for tapping lock-nuts made by the Morris Machine Tool Co.

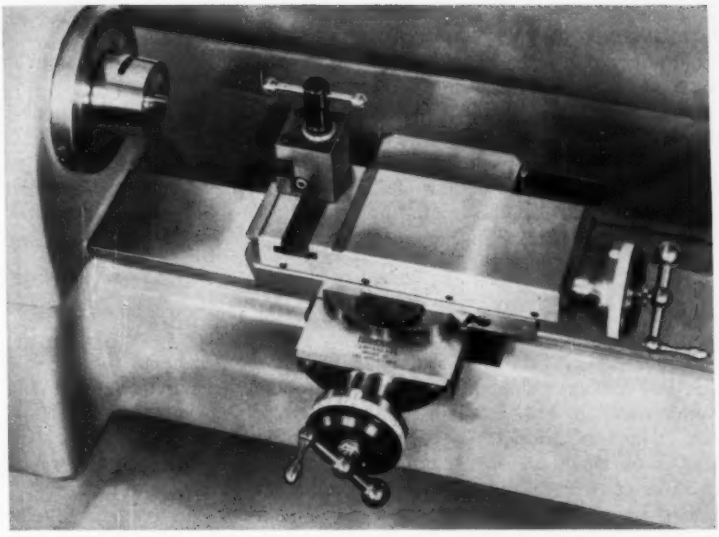


MSO universal grinder introduced in this country by Austin Industrial Corporation

Compound Slide-Rest for Hardinge Precision Lathes

A compound slide-rest is now available for all precision lathes built by Hardinge Brothers, Inc., Elmira, N. Y. This attachment is equipped with a rugged, square-body toolpost which takes standard 3/8-inch-square, high-speed steel or carbide tool bits. The toolpost has an integral screw-feed wedge type arrangement for holding the tool bit and is fast, accurate, and ideally suited for use with carbide tools.

Among the many advantages of this unit are magnified settings for precise angular adjustment of the index-slide. Easily read black and white feed-screw dials facilitate working to close tolerances. Completely covered feed-screws provide full protection against chips. The top slide is hardened-and-ground steel. The slide-rest has a double-lock arrangement for the index-slide.



Hardinge compound slide-rest designed for their precision lathes

Circle Item 590 on postcard, page 181

Bliss High-Speed Press

A 25-ton high-production press, Model 1625, with a proven production-line speed of 1000 strokes per minute, has been developed by the E. W. Bliss Co., Canton, Ohio. It is now in use at the Long Island City, N. Y., plant of Waldes-Kohinoor, Inc., where it is employed in the manufacture of Truarc rings. By means of a triple-cavity die, it stamps the rings in a variety of sizes and shapes at the rate of 3000 per minute. Designed and built at the Hastings, Mich., plant of the Bliss Co., the press incorporates a number of special design features which makes possible its extremely high speed. Most unusual of these is a revolutionary counterbalancing system which works in opposition to the force frequencies set up by the slide and, in effect, nullifies them, thus minimizing vibration.

Press equipped with triple-cavity die that stamps out 3000 rings per minute

Other special features include a recirculating oil system which provides lubrication to main bearings, connection bearings, and gibs. The oil system is monitored by interlocks which stop the press instantly if the pressure varies either up or down from the line pressure of 5 pounds. Not only will the interlocks shut the press down, but they immediately register the point of pressure failure—the source of the trouble—at a central lubrication-control panel. This permits quick correction without the necessity for tracing all oil lines.

An electric clutch permits rapid torque pick-up and extremely quick stops. There are roller bearings on the throw block, spherical bearings on the tube lever, and tapered anti-friction bearings on

the shaft mounting. The press has a half-inch stroke, with solid connections, and a bolster adjustment of 1 inch. The bed opening is 16 inches right-to-left, and 5 inches front-to-back. Bolster-plate area is 12 inches front-to-back and 20 inches right-to-left. Feeding coil strip into the press at an operating speed of 1000 strokes per minute made it necessary to develop a precision, light-duty, single-roll feed, set to pull the strip through the press.

In the Waldes Truarc retaining-ring application, strip stock 0.050 inch thick by 3 inches wide is fed into the press at a speed of 500 inches per minute.

Circle Item 591 on postcard, page 181

DoALL Articulated Band Machine

The DoALL Co., Des Plaines, Ill., has announced an articulated band machine, Fig. 1, designated the "Pan-Arm" Model 5. The capacity of this unit for handling extra-large or ungainly work is obtained by moving the cutting tool or band instead of the work. A sweeping head, double-hinge, and link construction provide over 99 square feet of unlimited cutting area, and a continuous straight-cut length of 17 1/2 feet. This makes it possible to shape and form large parts rapidly and economically, as well as cut off heavy tubing, plate, and structural shapes.

The sweeping head shown in the close-up view, Fig. 2, is a unique feature of this machine. The four-wheel, variable-speed band will cut work 21 inches thick. The head has a 60-inch throat depth and is swung on anti-friction hinges to an intermediate arm, and through that arm by another set of hinges to a floor-mounted pedestal. The cutting head is made of aluminum to minimize drag on the hinges.

The design of the guiding system for the cutting head is based on the fact that, while a properly supported saw band has great stiffness in the direction of the cut, it may be easily twisted. By making the upper and lower tool guides rotatable, the saw band can be turned through an angle of 360 degrees. By having the torque-motor-driven steel feed-wheel that rests on the floor plate interconnected to the rotatable guides by chains and countershaft, saw band and feed-wheel can be turned in unison. This enables the operator to "steer" the cutting head by means of a wheel attached to the upper guide, or by an optional remote-control unit. For rapid positioning, an air cylinder retracts the feed-wheel and then the cutting head swings freely. A chip conveyor conveniently discharges the chips at the back of the cutting head to clear the feed-wheel. The cutting head also carries the mist coolant system and the work illuminator.

The band speed range is from 25 to 5000 feet per minute. This permits saw bands from 1/4 to 1 inch wide, including Demon high-speed steel bands, to be used for efficient cutting of most materials. Efficient power transmission is obtained throughout the speed range by infinitely variable hydraulic motors coupled to three-speed transmissions. Driving two of the four carrier wheels assures full power at the cut. The output of a 10-hp, 20-gallon-per-minute pump is reserved for driving the band, while another 6-gallon-per-minute pump is used for regulating the main pump, for band tensioning, and for braking of the two free carrier wheels.

Two groups of controls are provided: a fixed group for setup and a movable group for operational control. The fixed controls are located on the cutting head. The operational controls are in a compact unit, attached to the machine by a patch cord. These controls are portable so that the operator may

Fig. 1. DoALL Pan-Arm Model 5 band machine developed for cutting large parts

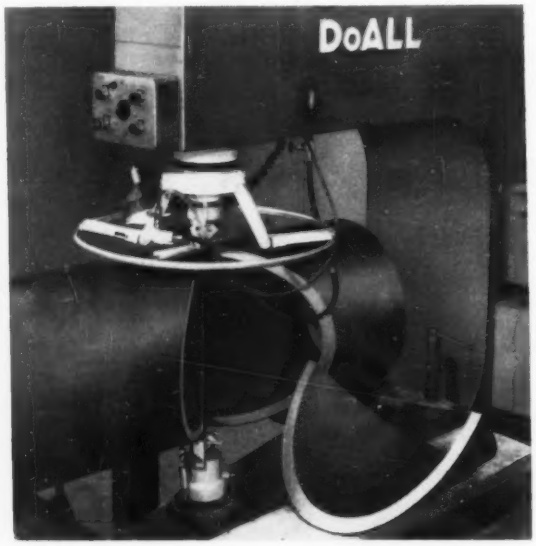
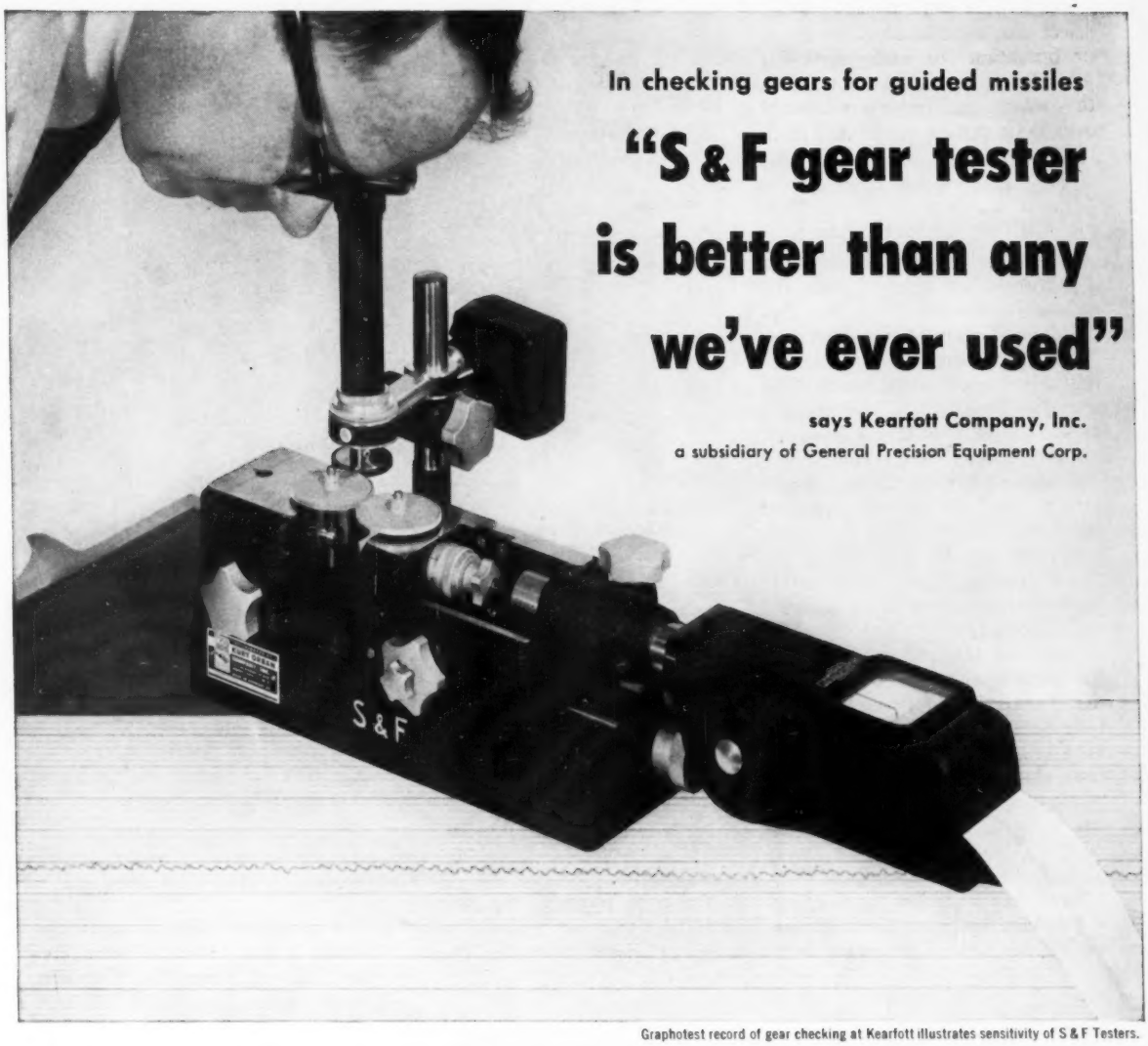


Fig. 2. Cutting heavy weldment part accurately to shape on Pan-Arm machine



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To insure the precision control and navigation of guided missiles and aircraft, Kearfott gears *must* be accurate within .00025". Kearfott technicians use seven S & F testers to check these gears and here's what they say about them: "Excellent for accuracy and repeatability—better than any tester used previously. They require minimum maintenance, are economical to buy and use."

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For more data, circle this page number on inquiry card 177

select the most convenient mode or operation for each particular job. The operator, as he watches the work, has finger-tip control over both cutting speed and feed.

Circle Item 592 on postcard, page 181

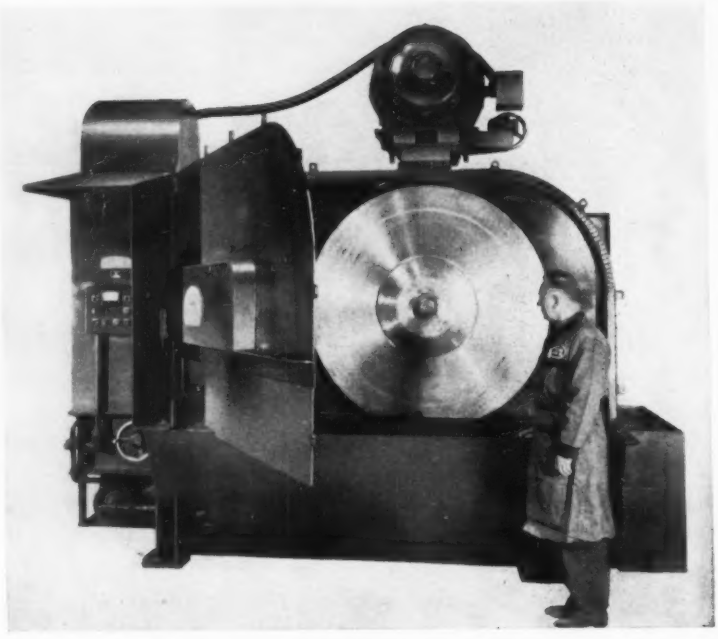
Ty-Sa-Man Friction Saw

A Model 150 friction saw with a cutting blade 60 inches in diameter is announced by the Ty-Sa-Man Machine Co., Knoxville, Tenn. This machine is similar in design to one described and illustrated in August, 1958, MACHINERY, page 156, but is of larger capacity. Like the latter unit, it is completely self-contained, with coolant reservoir in the base. The coolant system is so designed that it assures cool-edge, dry-blade cutting at all times. The friction saw is completely enclosed except for the material opening.

The steel safety shroud reduces the noise level and retains the hot, flying sparks. A safety window permits the operator to obtain a clear view of the work from a safe position close to the saw. An electronic variable-torque pressure feed maintains maximum cutting efficiency as the blade cuts through areas of varying density.

Complete control of the machine is provided by a push-button panel that is designed to enable relatively inexperienced men to master operation of the saw readily. Once a potentiometer on the control panel is set for the type of material to be cut, it automatically controls the feeding speed and pressure for the duration of the cut.

The main motor of the machine is 150 horsepower, and the pump motor, 15 horsepower. Cutting capacity ranges up to 24- by 12-inch channels, 24-inch I-beams, 11-inch standard pipe, 12-inch columns, and 4-inch squares and rounds.



Push-button controlled Ty-Sa-Man friction saw

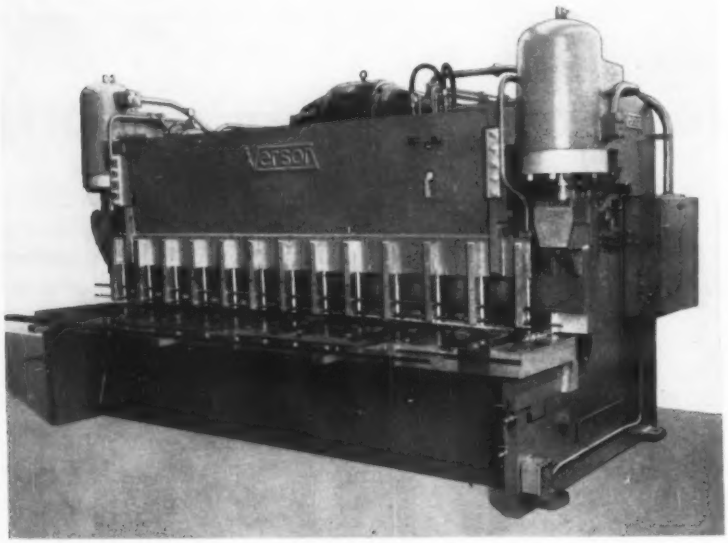
Circle Item 593 on postcard, page 181

Verson Hydraulic Shears

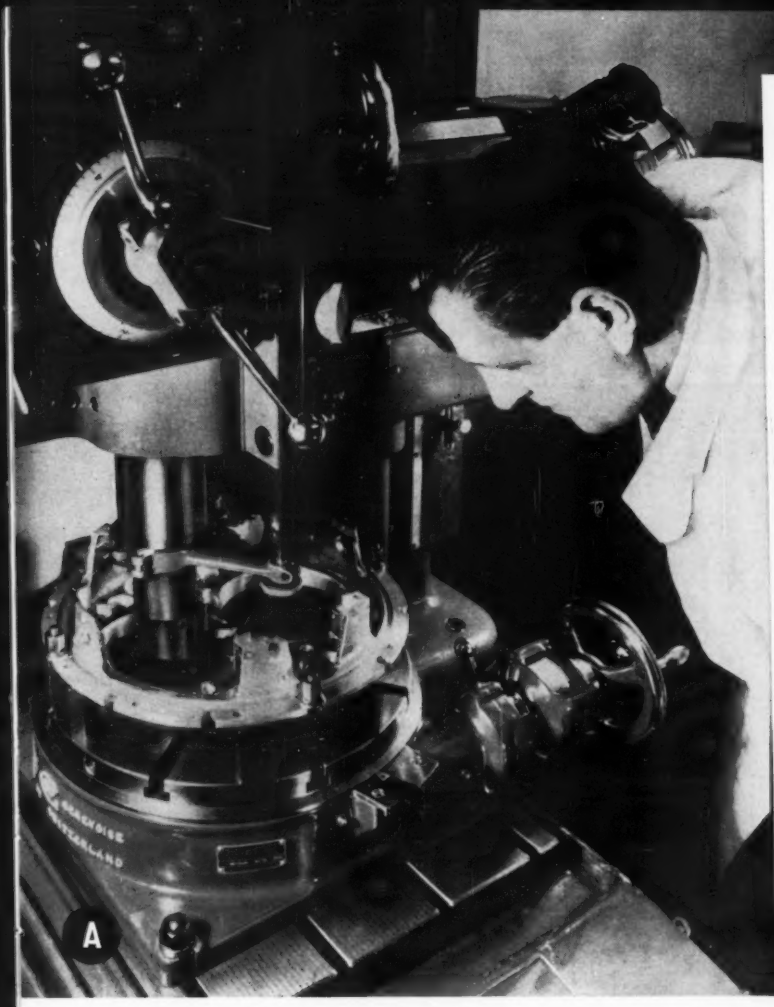
A complete line of hydraulic shears is now available from Verson Allsteel Press Co., Chicago, Ill. Machine capacities of standard models range from 8-foot lengths of 3/8-inch-thick mild steel, through 12-foot lengths of 1 1/2-inch-thick mild steel. In addition, special shears with capacities to meet practically any requirements are available. These machines will cut any material within their rated capacities. They are designed with a minimum shear angle of 1 1/6 inch per foot to eliminate curling of the cutoff piece, a definite asset when working with light-gage materials.

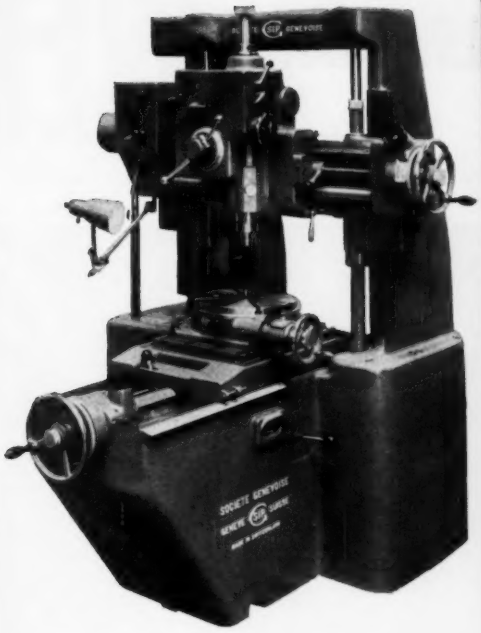
All shears are equipped with automatic control to keep the ram operating at a predetermined shear angle, which is adjustable by a handwheel located at the operator's station. Power-operated back gages are adjusted from the front of the press by easily accessible controls. Shears are also equipped

(Continued on page 186)



Verson hydraulic shear with capacity for shearing 12-foot lengths of 3/4-inch-thick mild steel

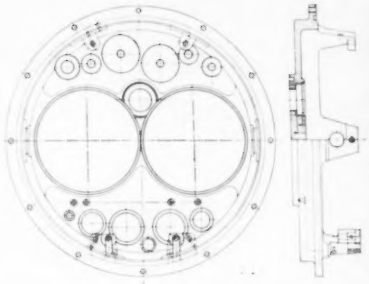


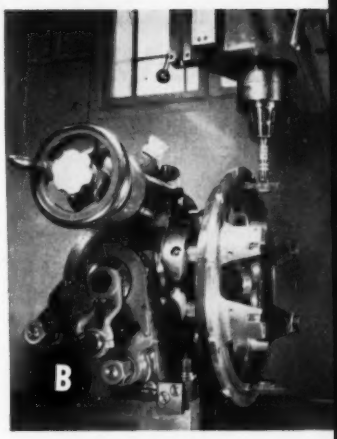


SIP No. 3K JIG BORING MACHINE
Send for Catalog 1173

Illustrated is the machining of a magnesium casting for an electronic unit . . . (A) drilling, boring and counterboring 37 holes, 62 diameters ranging from 0.255″ to 5.125″ . . . (B) drilling, boring and counterboring 11 holes, 16 diameters ranging from 0.100″ to 0.787″. Here's the record:

MACHINING TIME (A).....8 HOURS, 15 MINUTES
MACHINING TIME (B).....2 HOURS, 0 MINUTES





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The machine that does it is the SIP No. 3K Jig Boring Machine. It has what it takes—ease of operation, increased generous range and capacity, plus the basic Precision that is SIP—to finish critically sensitive jobs like this so fast and so well! SIP quality and precision cost you no more.

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WELDYNAMICS

NEWS ABOUT ARC WELDING AT WORK CUTTING COSTS

Press frame is typical of fabrication done at Paterson-Leitch.

WELDING COST SURVEY SHOWS WAY TO BIG SAVINGS AT PATERSON-LEITCH

A cost reduction survey at The Paterson-Leitch Company of Cleveland, one of northern Ohio's largest steel warehouses and fabricators, indicated possible savings of almost $22,000 a year.

The survey made on two typical types of welds indicated that phenomenal savings could be realized by several simple procedural changes to eliminate over-welding, and by switching from DC to AC machines to achieve the best performance from the Jetweld iron-powder electrode being used.

P. L. Holden, a Lincoln welding engineer, spotted the difficulty on one of his regular visits to the plant—offered to make the survey and received the approval of Mr. L. M. Hardnack, Plant Superintendent.

Mr. Hardnack stated, "Because our work is so varied, it's hard to pin down costs on every operation. However, we have tried to follow Mr. Holden's recommendations, and I would be safe to say that we have realized at least 60% of the predicted benefits."

Lou Hardnack, Plant Superintendent, "We appreciate the professional engineering services of the Lincoln man."

For help with procedures and cost reduction ideas call your Lincoln welding engineer today.

NEW IDEALARC WELDER TAILORED TO YOUR NEEDS

The new Lincoln Idealarc "TM" welder has been designed to meet the needs of any shop.

The key to the "TM" model's versatility is a wide range of options that expand the applications for the machine.

Basically the Idealarc "TM" is a transformer type AC or AC/DC machine, depending upon the choice of the owner, with a moveable core reactor current control. Many new features have been built into the machine to improve welding characteristics, increase efficiency and to protect the machine.

Special features such as remote current control, remote selector switch control, ML-2 power pack, 115 volt push-button control, and others, are optional to adapt the machine to any welding requirement. Some of the options are available in kit form and can be installed in the field.

These new Idealarcs are available in 300, 400, 500 and 650 amp sizes.

Bulletin 4607.1 has all the details and specifications. A copy may be obtained by writing The Lincoln Electric Company.

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NEW CATALOGUES

GRAY IRON CASTINGS—Gray Iron Founders' Society, Inc., Cleveland, Ohio. Directory and Buyers Guide covering manufacturers of gray iron castings. The 75-page paper-bound book includes three major sections: (a) an alphabetical list of members of the society; (b) a geographical listing of members; and (c) the Buyers Guide section. Copies are available on letterhead requests from the Gray Iron Founders' Society, National City-E 6th Bldg., Cleveland 14, Ohio.

FABRICATION PROBLEMS — Wales-Strippit, Inc., Akron, N. Y. Catalogue describing the Strippit System of punching, notching, nibbling, and drilling. Copies may be had by request on company letterhead to Wales-Strippit, Inc., 203 S. Buell Road, Akron, N. Y.

PLATING—The Linde Company, Division of Union Carbide Corporation, New York City. Booklet, "Linde 'Plasmarc' Plating," describing the new plasma arc service for metals in the high-temperature range. It presents the plasma arc torch, which operates at temperatures up to 30,000 degrees Kelvin, and engages in both the coating and fabrication of shapes for industries using ultra-hard materials such as pure tungsten, molybdenum, zirconium, and tantalum, as well as stainless steel and other metals. **501**

CONTRACT MANUFACTURING—Taft-Peirce Mfg. Co., Woonsocket, R. I. Catalogue No. 814, describing the Contract Service Division as an integrated engineering, toolmaking, and manufacturing organization which is available to companies desiring to add to existing plant facilities without incurring heavy capital expenditures. Detailed description covers such services as individual design, toolmaking, machining, heat-treating, production, assembly, and inspection. . . **502**

TAP EXTENSIONS—Walton Co., Hartford, Conn. Catalogue sheet No. 9500, covering a line of tap extensions (or tap holders) designed specifically for machine tapping operations. Now available for standard taps in sizes ranging from No. 0 to 1/2 inch, these Style "B" tap extensions save the added cost of extra-length taps frequently necessary when tapping deep or awkward location holes. . . **503**

FLOTATION SYSTEMS—Industrial Filtration Division, U. S. Hoffman Machinery Corporation, Syracuse, N. Y. Brochure (FB-102), describing flotation units employed in metalworking operations. By achieving continuous, fully automatic clarification of water-soluble oil coolants, the units are said to increase productivity of machine tools completely, and end down time due to failure of coolant supply and the need for sump cleaning. **504**

INSTRUMENT AND ELECTRONIC COMPONENTS—Pic Design Corporation, Subsidiary of Benrus Watch Co., Inc., East Rockaway, N. Y. 416-page catalogue No. 20, presenting diagrams and data on instrument, electronic, and tool components, and instrument kits. Tables give details about all types of gears, couplings, clocks, handles, assemblies, etc. **505**

ELECTRIC MOTORS—Warner Electric Brake & Clutch Co., Beloit, Wis. Brochure WEB P-52, describing "Electro-Sheave,"

For Advertisements—Circle Numbers

																						11
																					10	22
																				9	21	33
																			8	20	32	44
																		7	19	31	43	55
																	6	18	30	42	54	66
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											12	24	36	48	60	72	84	96	193	205	216	217
										23	35	47	59	71	83	95	191	203	215	226	227	228
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								45	57	69	81	93	187	201	213	224	236	247	248	249	250	261
							56	68	80	92	185	200	212	223	235	246	257	258	259	260	271	272
						67	79	91	183	199	211	222	234	245	256	267	268	269	270	271	282	283
					78	90	181	198	210	221	233	244	255	266	277	278	279	280	281	282	293	294
				89	101	179	197	209	220	232	243	254	265	276	287	288	289	291	292	293	304	305
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	122	134	174	194	206	217	229	240	251	262	273	284	295	701	712	713	714	715	716	717	718	719	720	721	722	723

COVERS: FRONT — INSIDE FRONT — INSIDE BACK — BACK

For New Equipment, Catalogues—Circle Item Numbers

																						511
																					510	522
																				509	521	533
																			508	520	532	544
																		507	519	531	543	555
																	506	518	530	542	554	566
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INTERNAL FORMING MACHINE—Cincinnati Milling Machine Co., Cincinnati, Ohio. Folder No. M-2060, presenting Cincinnati "Intraform" machines, the newest type of equipment in the "chipless-machining" field. Many metalworking operations, hitherto very difficult or practically impossible, can now be performed at a low-cost production rate on these machines. 507

LATHE—Jones & Lamson Machine Co., Springfield, Vt. Brochure describing the company's Model 30 Auto-Tracer lathe. Included are the machine's automatic tracing cycles and variable components available, with design features and specifications. Controls for quick setup and operation are explained. 508

LAMPS—Lamp Division, Westinghouse Electric Corporation, Bloomfield, N. J. Booklet describing a line of devices for the display of luminous letters and numerals in various types of dials and indicators in readout equipment. The new indicator devices shown in the booklet produce light by the phenomenon of electroluminescence. 509

TRACER CONTROL—General Electric Co., Schenectady, N. Y. Bulletin GEA-6122, describing tracer-control systems for a wide variety of metalworking applications. Vertical boring mills, skin milling machines, center-drive lathes, turret lathes, and contour-profile-milling machines are applications discussed. ..510

DIAMOND WHEELS—Simonds Abrasive Co., Philadelphia, Pa. Form ESA-290, an expanded, revised edition of the company's diamond grinding-wheel catalogue containing many additional items such as consumer net prices for both manmade and natural diamonds, six additional wheel shapes, and many additions of diamond depths. 511

SURFACE FINISH—Micrometrical Mfg. Co., Ann Arbor, Mich. Revised catalogue No. 159, describing all available instruments together with several special items which show the versatility of the "Profilometer," the trade name for a standard line of quality products for the measurement of surface finish. 512

GRINDING WHEELS—Blanchard Machine Co., Cambridge, Mass. Folder, entitled "The Inside Story," providing a tour of the Blanchard wheel plant with illustrations and explanations of the many modern techniques and processes used in the manufacture and testing of abrasive wheels and segments. 513

MOLDING MACHINES—Hydraulic Press Mfg. Co., A Division of Koehring Co., Mount Gilead, Ohio. Bulletin No. 5830-A, featuring H-P-M's complete line of machinery for molding plastics. This includes injection machines (both conventional and preplasticizing); compression, transfer, and reinforced plastics molding presses; and special machines. 514

DIAMOND DRESSING—Diamond Tool Co., Inc., Milford, N. H. Folder presenting a new concept in precision diamond dressing tools. It describes a method of orienting diamonds in holders so as to increase tool life and reduce maintenance and replacement costs while still holding competitive prices. 515

FASTENERS—Standard Pressed Steel Co., Jenkintown, Pa. Bulletin (Form 2460) featuring more than seventy different fasteners which are normally specified for aircraft, missile, engine, and related applications only by their national standard (NAS, AN, MS) designations. 516

PRESS WELDERS—Federal Machine & Welder Co., Warren, Ohio. Brochure P59, featuring a line of press type spot and projection welders. 517

SCREWDRIVER—Eastern Machine Screw Corporation, New Haven, Conn. Bulletin SD, featuring the Russell "Auto-Feed" screwdriver which can automatically feed and drive screws in a multiple of sizes ranging from No. 0-80 to 1/4 inch. 518

FASTENING TOOLS—Apex Machine & Tool Co., Dayton, Ohio. 206 pages of catalogue data giving complete specifications and descriptions of Apex nutrunning, screwdriving, and miscellaneous fastening tools. 519

JIG BORING AND GRINDING MACHINES—Moore Special Tool Co., Inc., Bridgeport, Conn. Brochure introducing three new machines, the No. 3 Moore precision jig borer, No.3 Moore precision jig grinder, and the Moore universal measuring machine. 520

BORING TOOLS—Davis Boring Tool Division, Giddings & Lewis Machine Tool Co., Fond du Lac, Wis. Bulletin DB-410-A, describing block type boring tools with square, precision-ground, throw-away carbide inserts. The new blocks are designed for standard Davis boring-bars. 521

SOLID-CARBIDE DRILLS—M. A. Ford Mfg. Co., Inc., Davenport, Iowa. Bulletin No. 810, offering a series of tips about the most effective methods of gaining high production and long tool life from "Hi-Roc" solid-carbide drills. 522

BORING—Heald Machine Co., Worcester, Mass. Brochure, "Production Tips," showing fourteen different setups to illustrate how various operations can be combined on a unit type Model O Bore-Matic for automatic machining simultaneously or in sequence. 523

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For Advertisements—Circle Numbers

| | | |

SURFACE GRINDER—Taft-Peirce Mfg. Co., Woonsocket, R. I. Bulletin No. MT-003, describing important saddle-control changes which have been made to increase the versatility and tenth-splitting performance of the Taft-Peirce No. 1 precision surface grinder. **524**

ARC WELDERS—Lincoln Electric Co., Cleveland, Ohio. Folder describing the company's "Idealarc" AC and AC/DC "TM" arc welders as well as special features. **525**

CEMENTED CARBIDES—Carmet Division of Allegheny Ludlum Steel Corporation, Detroit, Mich. Revised catalogue, "Cemented Carbides for Industry," giving information on brazed tools, carbide inserts, tool-holders, and blanks. **526**

LOCK-NUTS—Standard Pressed Steel Co., Jenkintown, Pa. Bulletin (Form 2487), featuring featherweight lock-nuts which combine exceptional strength-to-weight ratio with superior fatigue characteristics and high re-usability. **527**

NUCLEAR POWER—Babcock & Wilcox Co., Atomic Energy Division, New York City. Bulletin AEB-8, summarizing the company's activities in the nuclear field, ranging from the design and erection of complete reactors to the solution of design parameter problems. **528**

LATHES—Schauer Mfg. Corporation, Cincinnati, Ohio. Catalogue No. 580, describing the complete line of Schauer speed lathes. These machines are used throughout industry for polishing, lapping, deburring, and other secondary finishing work on metal and plastic parts. . . **529**

PRESSES — Dake Corporation, Grand Haven, Mich. Newly revised general catalogue No. 350A, featuring the company's complete press line, including electric, air-and hand-operated hydraulic presses, arbor presses, utility presses, and custom-engineered presses for specialized applications. **530**

SPROCKETS—Acme Chain Corporation, Holyoke, Mass. Catalogue containing a complete listing of the company's Grip-Master stock sprockets and flexible couplings for roller chains, including full dimensions, revised prices, mounting and dismounting instructions, and other engineering data. **531**

SOLID-CARBIDE TOOLS—Atrax Co., Newington, Conn. 148-page catalogue No. 159, containing price list and engineering data on 1230 standard-stock, solid-carbide tools and burrs with speed and feed charts, and machining recommendations for all tools. **532**

UNIT TOOLING—Tool Products Corporation, North Tonawanda, N. Y. Booklet illustrating and describing some of the many adaptations in the field of unit tooling and emphasizing the new field of light-metal extrusion fabrication. **533**

SPEED DRIVES—Dynamatic Division, Eaton Mfg. Co., Kenosha, Wis. Bulletin No. GB-3, describing a complete line of adjustable speed-drive equipment for industrial applications. **534**

HELICAL GEAR-MOTORS — General Electric Co., Schenectady, N. Y. Catalogue GEA-6704, describing in text and pictures construction features and applications of the company's helical gear-motors and speed-reducer line. . . . **535**

STEEL FORGINGS—Alco Products, Inc., Schenectady, N. Y. 40-page data book documenting case-histories, mechanical properties, and machining tests of its patented "Hi-Qua-Led" lead-additive steel forgings. **536**

HOSE—U. S. Flexible Tubing Co., Bartlett, Ill. Four bulletins containing information on all industrial applications of flexible metal hose and their components. **537**

GEAR CHECKING FIXTURE—Michigan Tool Co., Detroit, Mich. Bulletin No. 471, covering the various uses of the company's universal fixture for checking gears, hobs, and cutters. **538**

FIRE-CONTROL CHART—Walter Kidde & Co., Inc., Belleville, N. J. Wall chart explaining the three classes of fires and approved portable extinguishers. . . **539**

AUTOMATIC ASSEMBLY—Ferguson Machine Corporation, St. Louis, Mo. Bulletin No. 601, presenting means of justifying automatic assembly when economic feasibility is doubtful due to low production rates or requirements. **540**

AUTOMATIC BARREL EQUIPMENT—Udylite Corporation, Detroit, Mich. Bulletin giving information on the "VIP," a conveyor combining flexibility and fully automatic control for all metal-finishing processes. **541**

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PRESSES—Famco Machine Co., Kenosha, Wis. Bulletin showing the company's new line of power presses. Features as well as specifications are presented. **542**

CARBIDE—Adamas Carbide Corporation, Kenilworth, N. J. Catalogue No. 359, describing the company's complete line of tungsten-carbide tools, tool tips, dies, wear parts, and "Dex-A-Tools." . . . **543**

GEAR CHECKER—Michigan Tool Co., Detroit, Mich. Bulletin No. 607, covering its new low-cost, compact, and versatile gear checker designed for roll checking the most widely used gear sizes. . . **544**

SURFACE GRINDER—Landis Tool Co., Waynesboro, Pa. Catalogue CGS-59, describing and illustrating the company's complete line of abrasive, precision surface grinders. Complete specifications and features are included. **545**

MILLING CUTTERS—Viking Tool Co., Shelton, Conn. Catalogue No. 591, describing indexable-insert face mills and shell end mills that eliminate the need for cutter sections in regrinding. . . . **546**

HYDRAULIC PRESSES—King Machine & Mfg. Co., Los Angeles, Calif. Brochure presenting Model 300A Series presses in 65-, 125-,170-, and 300-ton capacities. **547**

ROLL FEEDS—Durant Tool Supply Co., Providence, R. I. Brochure featuring automatic roll feeds with accuracy within thousandths, with either friction clutch or "Select-O-Matic" indexer. **548**

PRECISION LATHES—Pratt & Whitney Co., Inc., West Hartford, Conn. Bulletin featuring the Wade No. 94 clutch hand turret lathe, now being sold by P & W. Specifications and illustrations are provided. **549**

BRASS ALLOYS—Bridgeport Brass Co., Bridgeport, Conn. Bulletin showing the importance of grain size of brass alloys. It explains how the selection of the correct, ultra-fine grain size can reduce a user's finishing costs. **550**

MODULAR MACHINES—Cleveland Hobbing & Machine Co., Cleveland, Ohio. Bulletin No. 204, describing lathes, profilers, and chuckers. Specifications and engineering data are given. **551**

HONING—Sunnen Products Co., St. Louis, Mo. Revised bulletin (X-Man-5000 I) on the company's precision honing machine, and its applications in production, maintenance, and toolroom work. **552**

CHEMICAL MILLING—United States Chemical Milling Corporation, Manhattan Beach, Calif. Design Bulletin No. 8, describing recent advances in the state of the art of chemically milled steel alloys. **553**

GRINDING GAGES—Federal Products Corporation, Providence, R. I. Catalogue covering the complete line of Arnold continuous grinding gages. **554**

COMPARATORS—Pratt & Whitney Co., Inc., West Hartford, Conn. Circular describing "Trans-O-Limit" comparators, giving data and specifications. **555**

DIAPHRAGM CHUCKS—Erickson Tool Co., Solon, Ohio. Bulletin describing the company's line of air-operated diaphragm chucks. **556**

For Advertisements—Circle Numbers

COVERS: FRONT — INSIDE FRONT — INSIDE BACK — BACK

For New Equipment, Catalogues—Circle Item Numbers

5/59

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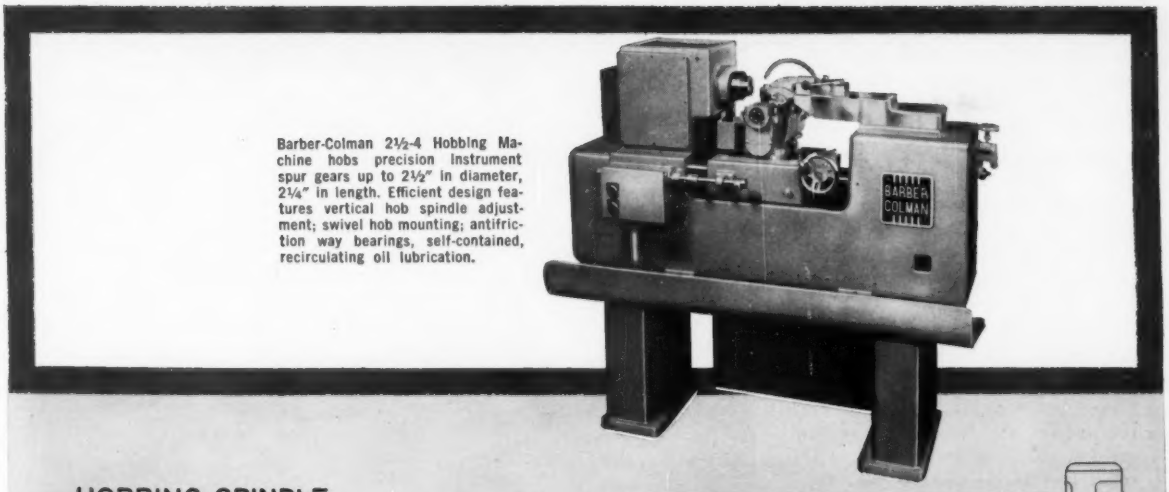
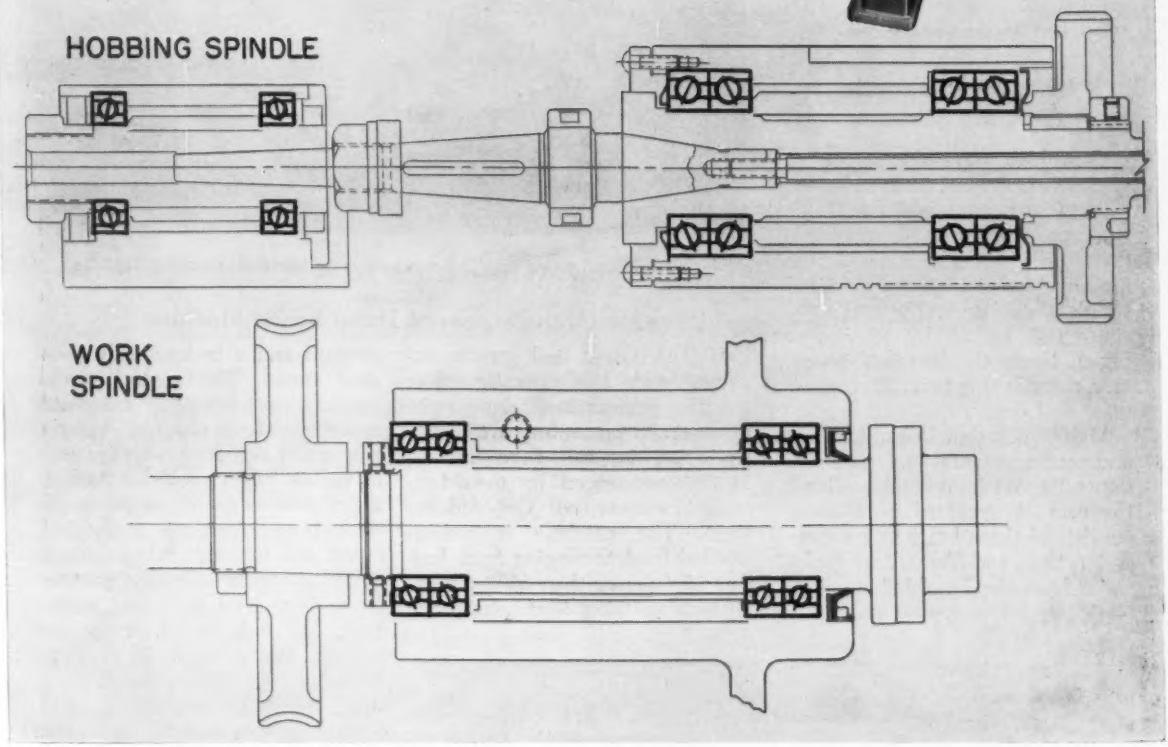


Barber-Colman 2½-4 Hobbing Machine hobs precision instrument spur gears up to 2½" in diameter, 2¼" in length. Efficient design features vertical hob spindle adjustment; swivel hob mounting; antifriction way bearings, self-contained, recirculating oil lubrication.



Relative rotation of hobbing machine spindles held accurate within 20 seconds using Fafnir Ball Bearings

New Barber-Colman 2½-4 machine precision-hobs spur gears for instruments

If two words can sum up the design of Barber-Colman's new 2½-4 Hobbing Machine, they are *accuracy* and *rigidity*.

Developed for hobbing AGMA Precision Class 3 fine-pitch spur gears for guidance systems, the 2½-4 has a minimum number of parts at points where deflection or inaccuracies might occur.

In selecting bearings which would complement the accuracy of the gears in the machine, Barber-Colman designers got the performance they wanted with Fafnir super-precision ball bearings. Single row, extra-light, counter-bore types, eight used in duplex pairs, help maintain indexing accuracy within *20 seconds*.

The application is typical of thousands Fafnir has handled where performance requirements put an extra premium on bearing selection. Chances are, Fafnir experience — plus breadth of line — can answer bearing problems you may have. Write The Fafnir Bearing Company, New Britain, Connecticut.

10 Fafnir Extra-Light Super-Precision Ball Bearings, snug fit, support the Barber-Colman 2½-4 machine spindles. 4 variations, equipped with composition retainers, are available in this one series to meet specific load and speed requirements where exceptional rigidity is wanted.

FAFNIR
BALL BEARINGS

For more data, circle this page number on inquiry card

with a front gage and a squaring arm for precise alignment of stock.

Ball transfers in the bed allow easy movement of stock. When properly aligned, stock is held in place by hydropneumatic hold-downs. Knife guards provide operator safety. Shear blades are readily accessible from the rear, permitting easy replacement.

A stroke control, with limit switches both top and bottom, is adjustable through the entire range of the stroke. When narrow pieces are sheared, the stroke can be easily shortened to obtain greater productivity.

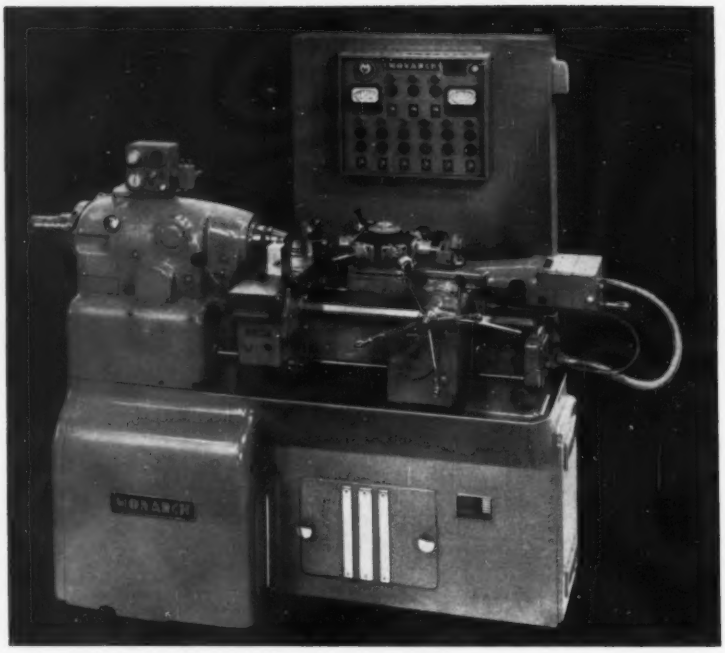
Circle Item 594 on postcard, page 181

Branson Ultrasonic Cleaning Systems

Complete ultrasonic cleaning systems in matched counter-height cabinets are now available from Branson Ultrasonic Corporation, Stamford, Conn. The Series C cabinets, welded of 16-gage type 316L stainless steel to uniform dimensions (26 by 24 by 32 inches high), house the Sonogen generator, the cleaning tank, filter, rinse tank, and dryer.

Many different combinations and arrangements are possible, depending on individual needs of the user. A standard installation consists of three basic units: generator, tank, and filter. Rinse tanks and a dryer may be added.

Circle Item 595 on postcard, page 181



Improved hand screw machine announced by Monarch Machine Tool Co.

Monarch Improved Hand Screw Machine

Higher output and greater accuracy with less operator effort are the performance characteristics claimed for an improved hand screw machine, called the "Speedi-Matic," announced by the Monarch Machine Tool Co., Sidney, Ohio. The machine is recommended for lots ranging from less than 25 to more than 2500 pieces. It features simplified electronic controls and a hydraulically powered turret. The control center provides pre-selected, automatic speed and feed changes. A separate speed may be pre-set for each of the six turret positions (including a reverse speed for tap withdrawal) and for each of the two cutoff and forming slide positions. Speed range is infinitely variable from 40 to 4000 rpm; feed range, from 1/8 inch to 16 inches per minute. Also included in the control center are a feed indicator, a dual revolution-per-minute and surface-feet-per-minute indicator, and a work-diameter selector.

As the power feed, ram type turret is manually retracted, it is hydraulically indexed, then located in the new position to an accuracy of 0.0002 inch or better by a hydraulically actuated locating plunger, and clamped in position hydraulically. Retraction of the turret farther than the index position permits manual rotation of the turret head. An easily set stop for turret positions allows setting for exact depth of cut. Working stroke of the turret is 5 inches. The feedbox is powered by an electronically controlled feed motor.

(Continued on page 188)

Branson ultrasonic cleaning system in matched cabinets

REDUCE DRILLING COSTS...

INCREASE HOLE ACCURACIES

RIGHT NOW!

. . . with your own standard twist drills sharpened to SPIRAL POINT — Cincinnati's new drill point geometry.

Drill PRECISION holes with Spiral Point **—all the way up to 1" diameter.**

Get accurate hole size . . . straighter, rounder, cleaner holes . . . and you eliminate secondary operations. Maintain hole-positioning accuracy without costly guide bushings or pre-centering. Get more holes per grind.

CONVERT

the twist drills in your plant to *precision Spiral Points* with the new Cincinnati SPIROPOINT® DRILL SHARPENER. It automatically applies this cost-saving geometry in a matter of seconds.

IMMEDIATE DELIVERY
on sizes to 1"

Improved Machining Through Research

CINCINNATI LATHE AND TOOL CO.

3207 Disney Street • Cincinnati 9, Ohio

"TRAY-TOP" Lathes / "CINCINNATI" Drilling Machines / "SPIROPOINT" Drill Sharpeners

For more data, circle this page number on inquiry card

Electrical controls are to JIC standards. The spindle-motor electronics consist of only two power tubes along with silicon diodes and other static types of electrical components. This control circuit is arranged in the form of a plug-in module for ease of maintenance. Another similar module is provided for the feed-control circuit. Drive to the spindle is from a 5-hp, direct-current motor. This gearless, stepless, and infinitely variable drive provides for both forward and reverse motion. Acceleration from 0 to 4000 rpm requires only two seconds; braking to a stop, only one and one-half seconds. Either an air- or lever-operated pusher type collet attachment may be used, both in connection with an air-operated bar feed. Bar-stock capacity is 7/8 inch.

Circle Item 596 on postcard, page 181

Hammond Abrasive-Belt Grinding Machine

Hammond Machinery Builders, Inc., Kalamazoo, Mich., announces a Model 600-P abrasive-belt grinder, claimed to be the least expensive platen grinder ever developed, which has all modern wet or dry grinding features. As a dry model, it is equipped with an exhaust outlet. Also, this model can be equipped at extra cost with a built-in DusKolector.

As a wet model, the 600-P has a new style sprayer which provides a heavy lay of water on the belt and complete flooding of the work. The sprayer is adjustable to the work height. A curtain attached to the sprayer (patent pending) traps splash from the work and table. Work temperature is kept at a minimum. A modern hood and large pan provide very effective spray and splash control. Thus, the operator and floor are kept dry. Wet-grinding has the advantages of better finish, less heat, and less work distortion. There is also less belt loading.

The steel platen is reversible top-to-bottom and front-to-back for maximum use. The pulleys are dynamically balanced for smooth operation and run on sealed ball bearings. The drive is by V-belt. On the dry model the DusKolector is located in the floor stand in place of the double-baffled coolant tank and pump on the wet model.

The abrasive belt (belt not furnished) is 6 by 48 inches and the belt speed, 3400 sfpm (surface feet per minute). The platen is 6 by 11 1/2 inches and the work rest, 3 by 8 1/2 inches. Coolant tank capacity is 5 gallons.

Circle Item 597 on postcard, page 181

Peer Precision Butt Welder

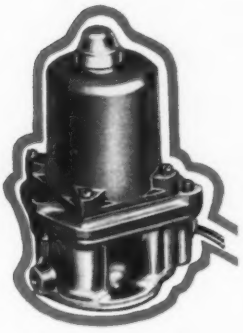
The butt welding of light wire parts can be accomplished easily and rapidly on this Model B-1 unit made by Peer, Inc., Benton Harbor, Mich. Machines like this were used to weld the thousands of steel wires woven together to form the heavy suspension cables that sup-

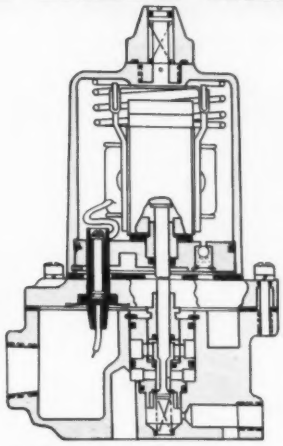
Abrasive-belt grinder brought out by Hammond Machinery Builders, Inc.

Precision butt welder for steel wires, made by Peer, Inc.

a basic Ross *valve building block*

GOLDMODEL VALVE HEAD





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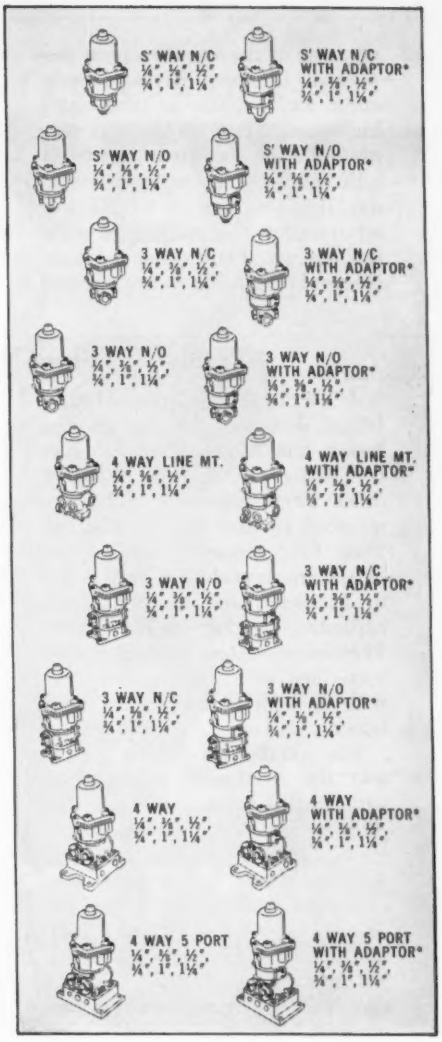
- The finest achievement in solenoid heads
- JIC
- Over 50 million cycles in tests
- Lightning fast

Modular construction is brought to the air valve field to give you the effect of a great valve inventory without stocking a great number of valves. Stock just one of these Goldmodel heads and you have the finest solenoid actuator obtainable for any one of the 54 Skyline bodies. This is the head designed especially for those uses where dependable performance and very long life must supersede all other considerations. The dustproof solenoid is the very finest and is immersed in oil to run cool and stay young. Write for bulletin 318.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WHITEMODEL SPOOL SOLENOID
WHITEMODEL SPOOL SOLENOID MOMENTARY ADAPTOR
"featured above"
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GREENMODEL DOUBLE SOLENOID MOMENTARY
BLUEMODEL AIR OPERATED
BLUEMODEL AIR OPERATED MOMENTARY ADAPTOR
BLUEMODEL AIR OPERATED TIMED IN
BLUEMODEL AIR OPERATED TIMED OUT

"every head meets every body at this gasket"

ALL SKYLINE HEADS AND BODIES ARE BUILDING BLOCKS TO GIVE YOU MANY VALVES FROM A FEW HEADS AND BODIES

STRAIGHTWAY NORMALLY OPEN NORMALLY CLOSED
3 WAY NORMALLY OPEN NORMALLY CLOSED
4 WAY
3 WAY NORMALLY OPEN NORMALLY CLOSED
4 WAY
4 WAY 5 PORT

STAY AHEAD

MODERNIZE

Ross **OPERATING VALVE COMPANY**

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port one of the world's largest suspension bridges. This same precision tool, capable of performing high-quality butt welding, is now available for the great variety of jobs that come up in shops everyday. It can be used for lengthening screws, pins, and rods; it joins the ends of saw blades, metal bands, etc.; and it joins the end of one reel of wire to another for continuous wire-production processes.

Butt welding is simple with this tool. Even unskilled operators can obtain perfect results by merely inserting the two pieces to be welded in the clamping dies, operating the clamping and upset levers, and pressing the "operate" button.

Circle Item 598 on postcard, page 181

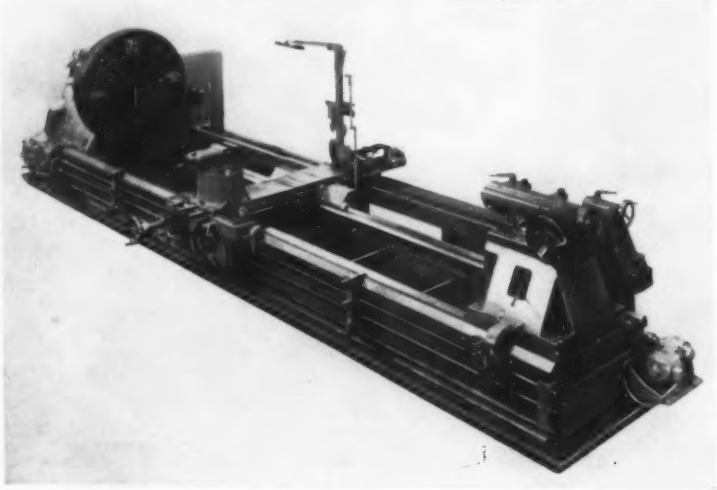
Sidney "Space-Master" Lathes

A series of "Space-Master" lathes designed for use in the rocket, missile, and allied fields, as well as for precision machining of other large parts, has been announced by the Sidney Machine Tool Co., Sidney, Ohio. These lathes are available in swings up to 72 inches and center-distance capacities ranging up to 50 feet. They incorporate a high degree of versatility and can be supplied with or without the Sidney fluid tracer.

The spindle has sixteen speeds and the headstock is equipped with lapped herringbone gears to provide for smoother operation, greater tooth contact, balanced gear loads, and longer gear life. Headstock bearings are of the precision taper-roller type. Sixty thread- and feed-change ratios are standard. For infinitely variable speeds, the Space-Masters are available also with direct-current motor drive.

A power operated rapid traverse has multiple-screw supports and operates in a totally enclosed housing. A safety clutch prevents damage if the carriage should run into an obstruction. The fluid tracer may be equipped with periscope mirrors which permit watching the tracer and template from the front of the machine even with large-diameter work in a lathe. Rapid approach and withdrawal of tools are provided for even when the fluid tracer is used. These movements of the tools when loading and unloading are obtained through a three-way valve operated by a lever at the front of the carriage. The tracer itself is operated through a separate power unit with its own separate control switch, so that the motor may be shut off when the tracer is not in use. The tracer is designed to permit use of either flat or round templates.

Circle Item 599 on postcard, page 181



"Space-Master" lathe announced by Sidney Machine Tool Co.

"Knuckle-Head" multiple-spindle drilling and tapping head

Ettco Drilling and Tapping Heads

A fully adjustable, four-spindle drilling and tapping head, designated the Model 400 "Knuckle-Head," has been announced by the Ettco Tool & Machine Co., Inc., Brooklyn, N. Y. This compact, lightweight unit is designed to perform small, delicate production operations. Little and easy to handle, it eliminates the need for using larger, more expensive and cumbersome adjustable heads for most small-size jobs. This unit is designed to operate in any position on any drill press, drilling or tapping unit, or other type machine. It will drill or tap two to four holes ranging in size from 1/32 to 1/4 inch in steel.

Spindles on this head are of the universal joint type and can be easily adjusted to almost any hole pattern within a 4-inch-diameter bolt circle with a 5/8-inch minimum center distance. Special spindles which allow a minimum center distance of 1/2 inch are also available. Spindles are adjusted to the desired position by means of a locating arm which, like the spindle shaft, can be added or removed without tools. Where the advantages of fixed-spindle operation are desired, jig-bored aluminum templates can be supplied.

Circle Item 600 on postcard, page 181

(This section continued on page 192)

introducing a

NEW

OLOFSSON

HEAVY DUTY PRECISION BORING MACHINE

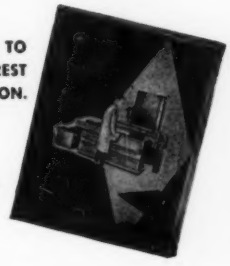
Designed for better precision finishing...semi-finishing...and roughing of large, bulky parts

This newest in the line of Olofsson Precision Boring Machines, the Model 22, is designed for more profitable heavy-duty rough and finishing boring, facing, chamfering, turning and grooving operations. Put one to work . . . and profit potential goes up. Because of the versatility of its new design, operating costs go down.

MODERN, WITH 22 QUALITY-DESIGN FEATURES, the Olofsson Model 22, weighs a hefty 7,600 lbs., untooled; and incorporates such design features as:

- *Extremely low ratio, height to width, of spindles to ways.*
- *Hardened and ground Alloy Steel flat and vee ways.*
- *Extra-large fixture mounting provides maximum stability for mounting large work pieces.*
- *Integral chip chutes completely surround any fixture tooling.*

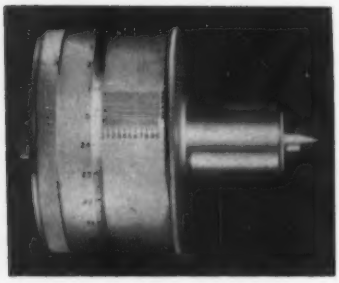
WHATEVER YOUR PRODUCTION REQUIREMENTS, IT WILL PAY YOU TO FULLY INVESTIGATE THE MODEL 22. CONTACT YOUR NEAREST OLOFSSON REPRESENTATIVE. Or, if you prefer, write direct to OLOFSSON.



THE OLOFSSON CORPORATION

2729 LYONS AVENUE, LANSING, MICH. *Phone:* IV anhoe 4-5381

MANUFACTURERS OF PRECISION BORING AND SPECIAL MACHINERY



Ultra-precise micrometer announced by Sheffield Corporation

Sheffield Ultra-Precise Micrometer

The Sheffield Corporation, Dayton, Ohio, a subsidiary of Bendix Aviation Corporation, has developed an ultra-precise micrometer that is accurate to plus or minus ten millionths of an inch per inch (plus or minus 0.000010 inch). This device has a 4-inch diameter barrel designed for easy reading. It is available for immediate delivery in two standard size ranges: 0 to 1 inch and 0 to 2 inches.

Micrometers can be made to suit individual requirements with graduations on the satin-finish thimble and barrel arranged for reading right or left, normal or reverse. The lead-screw, nut, and barrel of each micrometer are calibrated as an integral unit at the Eli Whitney Metrology Laboratory, and the serial number registered. Two other micrometer models of this type are also available. One is made to an accuracy of plus or minus 0.000015 inch per inch and the other to plus or minus 0.000020 inch per inch.

Circle Item 601 on postcard, page 181

Petermann Swiss Automatic Screw Machines

The Arthur Loeffel Co., Inc., Merrick, N. Y., announces its exclusive U. S. distributorship of the Petermann Swiss automatic screw machine, a six- or four-spindle turret unit designed for ultra-fast indexing. Outstanding features of these precision machines include exclusive micro differential micrometers; lever-actuated, flat cam headstock advance; built-in gearbox for both feed and spindle speed changes; headstock with "Nadella" needle bearings; electronic camshaft variator; and fully automatic lubrication.

This equipment is available in six capacities ranging from 1/8 inch to 1 1/16 inches. It has six "Transversal" tools and turrets with six or four spindles. Multiple combinations offer an easy solution to a considerable number of precision machining problems.

All six spindles of the turret drum can be either rotating or stationary, or arranged in any combination of rotating and stationary operating sequence. The rotating spindle can be used equally well for drilling, tapping, or external threading, using either a button die or self-opening die-head (left- or right-hand). The various rotating spindle speeds are obtained through the positioning of electrical contacts which operate one of the three electromagnetic clutches. There are no gears to change inside the drum.

It is possible to oscillate the turret drum for operations on components such as internal grooving or undercutting. Each spindle is provided with an adjustable device that permits rapid advance to the work. The indexing mechanism of the turret is controlled by an adjustable trip disc fixed to the camshaft of the machine.

Circle Item 602 on postcard, page 181

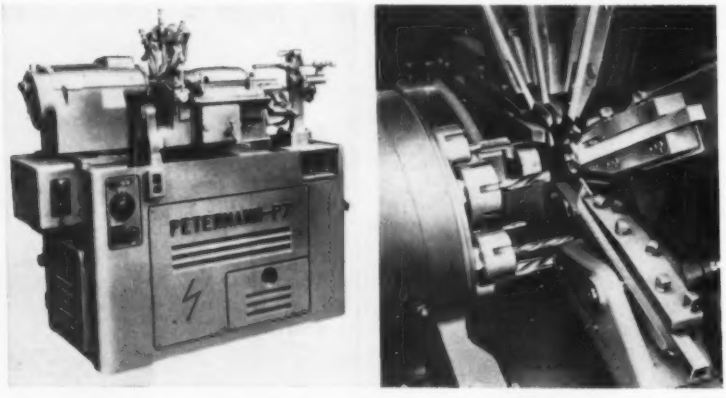
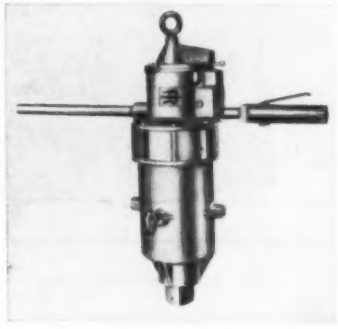


Fig. 1. (Left) Petermann automatic screw machine introduced in this country by Arthur Loeffel Co., Inc. Fig. 2. (Right) Close-up view of work and tooling on machine illustrated in Fig. 1



Impactool for heavy nut running developed by Ingersoll-Rand Co.

Giant Air Impactool for Heavy-Duty Nut Running

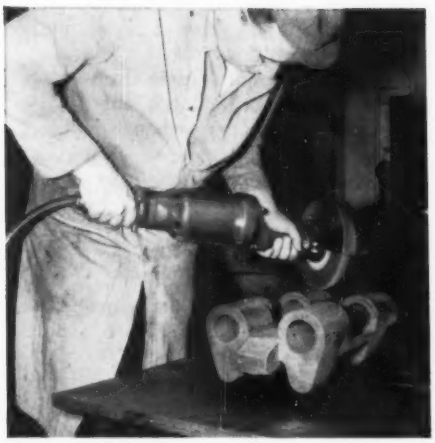
An air Impactool of great power and speed for tightening and removing nuts on bolts from 0 to 12 inches in diameter has recently been developed by the Ingersoll-Rand Co., New York City. Known as the Size 599 "Super Slugger" Impactool, this model is said to have four times the slugging power of any wrench previously available. It is designed for use in the manufacture and maintenance of very heavy machinery, such as is found in the power-generation, petroleum, and steel-mill industries. Since the tool is handled by a hoist or crane, it has been designed for easy positioning with eye-bolt suspension for either vertical or horizontal use. By eliminating manual nut-running methods, as well as sledging of frozen nuts, it reduces down time, job hazards, and fatigue, while raising production.

The tool is equipped for two-

ANNOUNCING NEW HEAVY DUTY 6" AND 8" HICYCLE GRINDERS

Heavy Duty Hicycle Angle Grinder with rotating wheel guard.

Heavy Duty Hicycle Angle Sander with 9" pad.



Model CP-550-SG-4500 Heavy Duty Grinder maintains speed under load, lets the operator really lean into the work.

Here are two *all new* CP heavy duty Hicycle Grinders . . . brutes for power, demons for speed. Hicycle squirrel-cage induction motors running on 180 cycles, 220 volt, 3 phase current provide Built-in Overspeed Protection because maximum speed is always constant, always within safe wheel limits . . . speed sag under load is less than 15%.

New with these models is the CP *"Tri-Flo" Cooling* System that minimizes "hot spots". This highly efficient system cools motor windings, rotor shaft, main bearings, gear case and switch. Keeps the temperature rise at key points as much as 28° lower than with conventional type cooling.

You get these 7 extra advantages with CP Hicycle Grinders

1—*Hicycle Motor* of advanced squirrel-cage design means no brushes to replace, no armature to burn out. 2—*Power/Weight Ratio* is outstanding because high strength magnesium castings are used for motor, gear case and switch handle. 3—*Oil Sealed Ball Bearings* lubricated for life. 4—*Interchangeable* motors, motor housings, switch handles and switches on all straight and angle models. 5—*Heavy-duty switches* have dust tight seals and phenolic spacers for insulation from motor and to minimize vibration. 6—*Extra heavy micro-mesh gearing* heat-treated for long service. 7—*Guards* fully conforming to A. S. A. safety codes.

Write for complete information on these newest CP Hicycle Heavy Duty Grinders. Chicago Pneumatic Tool Company, 8 East 44th Street, New York 17, N. Y.

Chicago Pneumatic

ELECTRIC TOOLS • PNEUMATIC TOOLS • AIR COMPRESSORS • DIESEL ENGINES • ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES

man operation and has a reversible motor. Its ball-and-cam impact mechanism has operated successfully and safely on other Impactools in a wide range of sizes. The "Super Slugger" runs with a free speed of 330 rpm, and delivers 500 blows per minute when impacting. It weighs 599 pounds, has an overall length of 37 1/2 inches, a side-to-center dimension of 7 7/8 inches, and a nose diameter of 11 3/4 inches. It is available with heavy-duty impact type sockets and a 3 1/3-inch-square socket driver.

Circle Item 603 on postcard, page 181

Landis type DE Landmatic die-head

"Pull-Off"–"Push-Off" Die-Head

A combination "push-off"–"pull-off" die-head series announced by the Landis Machine Co., Waynesboro, Pa., is available for Brown & Sharpe automatics, turret lathes, and other machines employing a stationary type die-head. Designated Type "DE Landmatic," the new series replaces the EXX style Landmatic which incorporated "push-off" action only. The new series is available in two sizes, the No. 4 (1/2 inch) with a No. 4 to 1/2 inch range for application to Nos. 0, 0G, 2, and 2G Brown & Sharpe machines, and the No. 5 (5/8 inch) having a range of No. 4 to 5/8 inch for use on No. 2 and 2G Brown & Sharpe machines. Auxiliary equipment allows the No. 4 head to produce threads on diameters up to 3/4 inch and the No. 5 up to 1 inch.

The DE heads are designed to allow either the "pull-off" (internal) or "push-off" (external) head-opening features to be used as desired without making head alterations. Pull-off action is obtained by interrupting the forward travel of the machine's slide to allow the die-head to advance by the self-leading action of the chasers until opening of the head occurs. When using push-off action, the trip mechanism contacts a stop on the machine to effect opening of the head.

Circle Item 604 on postcard, page 181

King Hydraulic Presses

The King Machine & Mfg. Co., Los Angeles, Calif., is now building a line of standard hydraulic presses in capacities from 65 to 300 tons, as well as any type of special hydraulic press. Designed by A. Dale Herman, Inc., Encino, Calif., the units (Fig. 1) are built to hold deflection to a minimum and assure accurate closure of the platens on the work stroke.

These presses are designed to permit conversion to higher capacities of 125, 170, and 300 tons from the basic 65-ton unit. This offers the purchaser the advantage of low first cost in a machine of the tonnage suited for his immediate requirements, with

Fig. 1. Hydraulic press built by the King Machine & Mfg. Co.

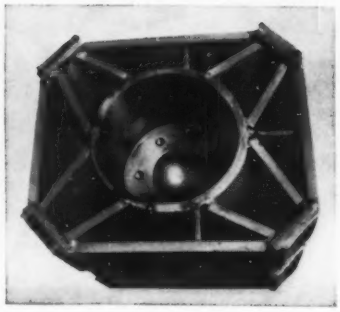


Fig. 2. Box type platen of press shown in Fig. 1

greater capacity available in the same piece of equipment at nominal cost.

This line, called the 300A series, is supplied with complete, self-contained hydraulic systems and controls. The basic frame and upper platen are all designed for 300 tons loading. The eight gibs of the box type platen shown in Fig. 2 are entirely contained at every point in the stroke by the ram ways. The box type platen also serves as a seepage basin for collecting oil should a packing gland develop a leak. Any oil so collected can be drained off without contaminating the working areas. The cylinder is provided with a replaceable Ampco bronze liner and cast-iron piston-rings.

The exposed main ram provides mounting area for hold-down cylinders when double-action setups are required. Standardization of cylinder components is accomplished by utilizing basic designs and parts from the King line of large cylinders (5 inches upward) made for road machinery and machine tools. These cylinders are available for pressures up to 5000 psi. A simple lever control is standard but automatic-cycling controls may be supplied if desired.

The basic frame, which is supplied in four press capacities of 300, 170, 125, and 65 tons, has the following specifications: platen dimensions, 26 3/4 by 32 inches; daylight opening, 25 inches; opening rate, 2.7 inches per second or 130.2 inches per minute; closing rate, 1.35 inches per second or 93 inches per minute; stroke, 12 inches; weight, (170-ton press)

Aluminum or zinc clad steel by production metallizing

- *any shape or size*
- *unlimited thickness*
- *no heat distortion*

Modern metallizing provides the product engineer with an extremely flexible, practical method of producing aluminum or zinc clad steel parts. High speed, automated metal spray equipment applies these coatings to practically unlimited thicknesses on any shape or size part without heat distortion.

a typical example

problem: **provide uniform heat distribution on thin steel shell**

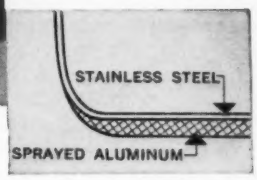
The excellent sanitary qualities of stainless steel make it an extremely desirable material for cooking utensils. But with the comparatively thin, drawn shells (.020" to .050"—varying by manufacturer), uniform distribution of heat presents a problem.

The solution is being provided for a number of high-volume manufacturers by metallized aluminum. Surface preparation is by grit-blasting as the shells rotate on a spindle. Metco Aluminum is then sprayed on the bottom, with automated traverse equipment, to closely controlled thicknesses (from .040" to .120", depending on the particular utensil and its manufacturer). The sprayed aluminum is carried up the sides beyond the radius and is tapered off according to individual design.

This is but one of many solutions to fabrication problems offered by sprayed metals to design engineers. In addition to the aluminum example given, zinc is also commonly used for corrosion-proofing in many production applications, such as steel capacitor cases, refrigerator parts, pole line hardware, etc. Sprayed zinc is also used to replace coatings burned, threaded, or machined off during fabrication.

For a round-up of some typical applications and engineering data on the characteristics of metallized coatings, write for Bulletin No. 136-A.

FREE BULLETIN ▶



METCO—Reg. U.S. Pat. Off.

Metallizing Engineering Co., Inc.

1131 Prospect Avenue, Westbury, Long Island, N. Y. · cable: METCO
Telephone: EDgewood 4-1300
In Great Britain:
METALLIZING EQUIPMENT COMPANY, LTD.—Chobham near Woking, England

Mr. Donald A. Watson
Metallizing Engineering Co., Inc.
1131 Prospect Avenue, Westbury, Long Island, New York

Please send me ☐ Bulletin 136-A

Name Title

Company

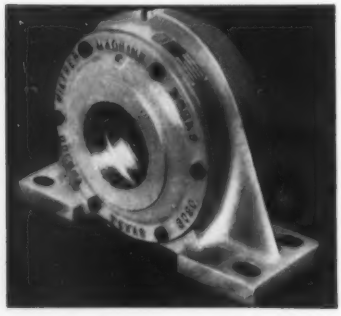
Address City State

approximately 15,000 pounds; and over-all dimensions, 56 inches wide, 30 inches deep, and 13 feet 4 inches high.

Circle Item 605 on postcard, page 181

Pillow Blocks for Heavy Industrial Use

A line of pillow blocks announced by Miether Machine Works, Odessa, Tex., is designed to accommodate all series of spherical roller bearings. It is said to offer new versatility for heavy



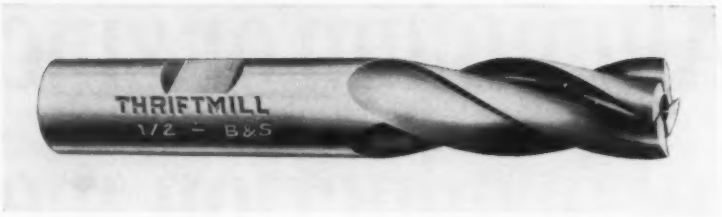
Miether pillow block that takes several sizes of bearings

industrial use. Through interchangeable end caps, twenty basic housings will accommodate ninety-four separate bearings. Some housings take as many as eight different bearing sizes and up to eleven separate shaft diameters.

To install a bearing of a different size, it is necessary only to fit new end caps on the housing. End caps and housings are jig-drilled for perfect interchangeability. According to the manufacturer, this feature makes the pillow blocks more adaptable to a change-over or new installation. For further versatility, the housings are center-grooved for universal center lubrication (W-20 and W-33 specifications), and end caps have a second connection for side lubrication. Either labyrinth closures or oil seals are available.

End caps are removable for easy installation or adjustment of bearings. To simplify parts replacement, the housings bear an "Easy-Order Plate" stamped with the assembly number, the size of bearing, adapter, and shaft, and the type of closure.

Circle Item 606 on postcard, page 181



"Thriftmill" for high-speed profiling, slotting, and peripheral milling

Brown & Sharpe "Thriftmill"

Brown & Sharpe Mfg. Co., Cutting Tool Division, Providence, R. I., is now offering the metalworking industry a high-speed "Thriftmill." This tool has been developed to achieve greater economy in performing such operations as profiling, slotting, and peripheral milling. It is ground from the solid by volume-production methods which are said to make possible savings of from 15 to 20 per cent over the cost of conventional end mills. Shop tests with the Thriftmill have shown exceptional results on over 80 per cent of the conventional end mill applications. Thus, it virtually brings the "throw-away" tool concept to many end mill applications.

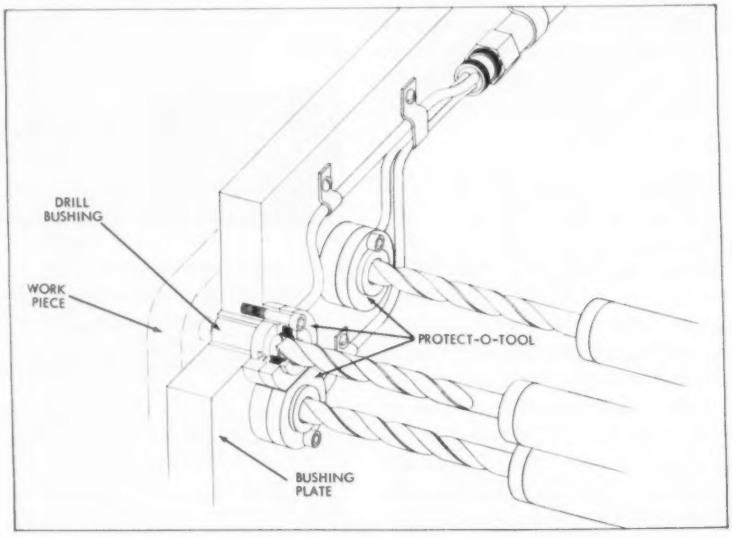
The Thriftmill is being produced in the most popular end mill sizes. It has a 10-degree rake, 30-degree helix angle, and is made for right-hand cutting. Six sizes with diameters ranging from 1/8 to 1/2 inch will be available.

Circle Item 607 on postcard, page 181

Cross "Protect-O-Tool" Broken-Tool Detector

One of the latest cost-saving and tool-damage perventive developments for transfer type production machines is a broken-tool detector announced by The Cross Co., Detroit, Mich. This device eliminates separate probe and inspection heads and stations, prevents processing of "scrap" parts and, by signalling the control panel and shutting down the machine when one tool breaks, prevents additional tool damage.

Designated the "Protect-O-Tool," this "intelligence" device is an electronic mechanism that "senses" the presence or absence of a tool—or even a part of a tool, in cases where a small piece of a drill or tap breaks off and remains



Cross "Protect-O-Tool" units that "sense" presence of broken tools or note absence of missing tools

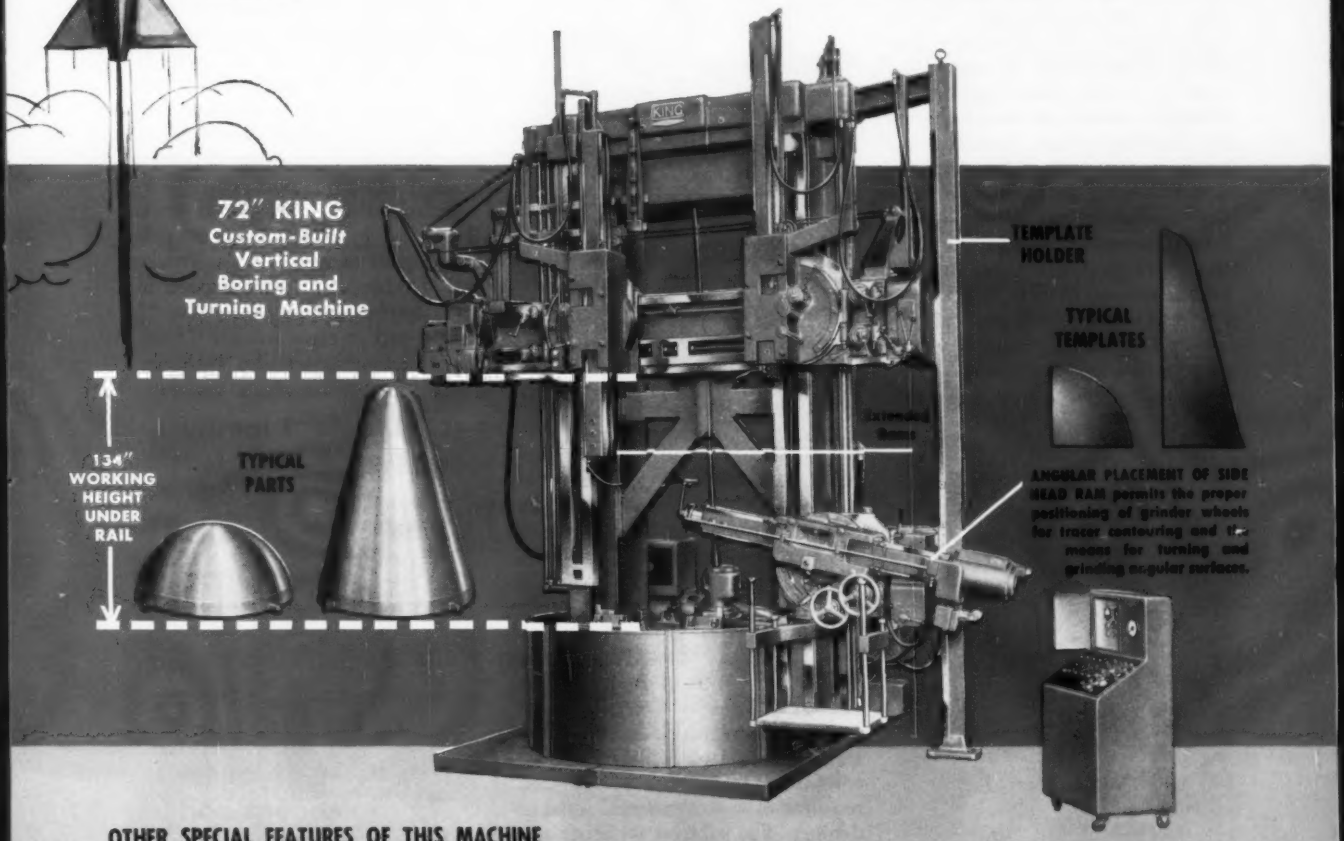
Another **KING** "Defense Production Special"

"Tailor-Made" to Specific MISSILE Requirements ...Yet Retaining All General-Duty Features

Recently installed in one of the nation's leading aircraft plants, this specially-built unit is a good example of the wide range of design versatility which is available in KING® Vertical Boring and Turning Machines.

When you buy a custom-designed KING machine, you buy only the accessory equipment, electrical controls, and design modification which your special-work machining operation requires—*no more and no less!* And always, you have in the basic machine all the standard facilities for general-purpose boring, facing, and turning.

This KING combination of special features and general-purpose facilities makes *all the difference* in competitive cost-control.



OTHER SPECIAL FEATURES OF THIS MACHINE

- **Swiveling type side head** arranged for tracer controlled turning and grinding operations.
- **Grinding attachment** with multi-speed precision motorized spindle extending through side head ram and arranged to receive interchangeable quills. Attachment includes balancing type wheel holders and wheel guard with exhaust outlet.
- **3-position tool holder for side head,** which can be readily interchanged with grinder quills for turning operations.
- **Operator carrier platform attached to side head,**
- **Console control system.**
- **Electronic, two-dimensional (360°) tracer mounted on side head.** Template holder arranged to support templates of the type required for work pieces utilizing full capacity of the machine. Universal adjustment is provided for the tracer head.
- **Electronic, two-dimensional (360°) tracer mounted on rail head.** Template holder mounted on top of rail to provide maximum work clearance above table. Positioning controls for stylus head for operator convenience.
- **Constant surface cutting speed attachment and constant chip thickness controls** applied to both tracer heads.
- **Coolant** conducted through rail head rams.

For further details on KING machines—standard 30" to 144" designs or special custom-built units—see your authorized KING Distributor, or write to us direct.

AMERICAN STEEL FOUNDRIES, KING MACHINE TOOL DIVISION
1150 TENNESSEE AVENUE, CINCINNATI 29, OHIO

KING Vertical Boring and Turning Machines

in the work-piece. The device is mounted on bushing plates behind the regular drill bushing hole (See illustration). Tool detection occurs as the drill or tap passes through the detector before and after machining.

Probably the most important or greatest savings obtained by the use of the tool detectors results from the elimination of useless machining operations on spoiled parts. This is especially true in the case of production lines where conventional probe and inspection stations are widely separated. In some instances, parts may be machined in twenty stations between the checking points. Should a tool break in the part at the first station following an inspection, useless machining operations would be performed on as many as nineteen scrapped parts before the break became known. Use of the Protect-O-Tool would prevent this by shutting the machine down as soon as tool failure occurred.

Circle Item 608 on postcard, page 181

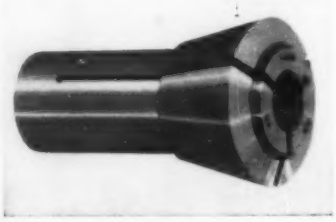
Simonds "Multi-Kut" File

"Multi-Kut" files designed to give maximum stock removal, smooth finish, and long life when used on any fileable material announced by Simonds Saw & Steel Co., Fitchburg, Mass. This addition to the Simonds line of "Red Tang" files will be available in flat, half-round, and square shapes and four lengths, 8, 10, 12, and 14 inches. The diamond-formation chip-breaking grooves and varied shapes are said to make them extremely useful all-around files.

Circle Item 609 on postcard, page 181

Steel Collets for Jacobs Chucks

Low-cost steel collet of line developed for use in Jacobs spindle-nose chucks by Hardinge Brothers, Inc., Elmira, N. Y. These collets are made in various sizes and in styles for holding round, hexagon, and square work-pieces. They are also available in an emergency collet type which has a soft face



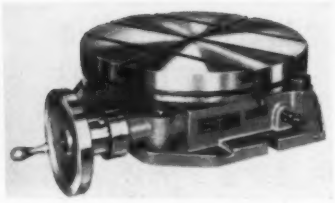
and pilot hole. This type permits rapid boring and stepping out when in place in the chuck.

Circle Item 610 on postcard, page 181

Multiple-Switch Indicator

Multiple-switch indicator for rapidly checking temperatures at many points announced by Wheelco Instruments Division of the Barber-Colman Co., Rockford, Ill. This 9000 Series indicator is available with switching details that allow the instrument to be used for as many as 108 stations. Additional stations may be included by the use of an additional switch housing cabinet. The basic instrument is a completely self-contained, null-balance unit and requires only the external sensing devices. The selector switches are of the three-position, spring-return type with double-pole, double-throw action. Other variables may also be indicated.

Circle Item 611 on postcard, page 181



Troyke Rotary Table

Rotary table announced by the Troyke Mfg. Co., Cincinnati, Ohio. It has been redesigned to incorporate additional features and provide greater accuracy for performing a variety of operations. It can be used for cutting segments of circles and circular slots, milling clutch teeth, locating angularly spaced holes or slots, cutting irregular contours, and similar work. The total guaranteed accuracy is 60 seconds of arc, or less. Troyke rotary tables are manufactured in six diameters ranging from 9 to 25 inches and in eight models. Dividing attachments are also available.

Circle Item 612 on postcard, page 181

Bausch & Lomb Long-Wearing Safety Glasses

Safety glasses, designated the C-20, announced by the Bausch & Lomb Optical Co., Rochester, N. Y. They have been specially designed to combine long-wearing comfort and functional good looks with the protection of safety glasses. They have a combination plastic and metal frame, with top rims and temples in dark brown, constrasting with white metal eyewires and engraved bridge. A strong, durable front of nickel silver completely encircles the lenses, assuring full protection.

(Continued on page 200)

NEW *from* GRAND RAPIDS

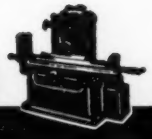
No. 350 PRECISION TOOL ROOM TYPE HYDRAULIC FEED SURFACE GRINDER

and just look at all these features:

- Powered vertical movement of wheel head*
- Instantly variable hydraulic table speed
- Greased-for-life precision ball bearing spindle with two speeds for long wheel life
- Head carried on protected pre-loaded ball bearing ways
- Equipped with Vickers vane type pump and our own control valve for infinite longitudinal table speeds from 5″ to 120′ per minute
- Variable speeds hydraulic cross feed and continuous cross feed
- Rugged, one-piece casting column and base for permanent rigid alignment
- Ultimate in accuracy with micro inch finish at production speeds

**Automatic downfeed available as optional feature*

For full details, just send a note on your letterhead.



GALLMEYER & LIVINGSTON

GALLMEYER & LIVINGSTON CO.
305 Straight Ave., S.W., Grand Rapids, Mich.

For more data, circle this page number on inquiry card

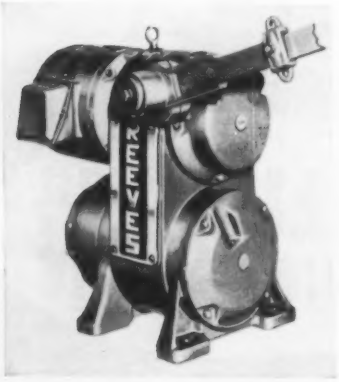
The frame features a sturdy bridge construction of extra strength firmly united to the eyewires by wide solder joints. The C-20 has high-quality Bal-SAFE lenses, heat-treated for impact protection. These lenses can withstand a blow which is up to fourteen times heavier than that required by Federal specification. Modern lens shape provides a wide field of vision, and will accommodate any individual prescription, single vision or bifocal. Where glare protection is necessary, the C-20 is available for Ray-Ban green lenses in two different shades.

Circle Item 613 on postcard, page 181

Automatic Control for Reeves "Motodrives"

Mechanical device for automatically changing speeds on its line of "Vari-Speed Motodrives" from 1/4 through 10 hp introduced by Reeves Pulley Co., Columbus, Ind., a division of Reliance Electric & Engineering Co. This mechanical automatic control has an extended lever which replaces the conventional speed-changing handwheel. Lever can be connected to any type of mechanical linkage to give the Motodrives automatic speed-change ratios of from 2 to 1 up to 10 to 1, depending upon the style and horsepower of the unit. The sensitive mechanism accurately changes drive output speeds from extremely low to high with slight mechanical pressure and short travel. A built-in safety device protects the Motodrive from excessive force.

Circle Item 614 on postcard, page 181



Airco Hand Cutting Torch

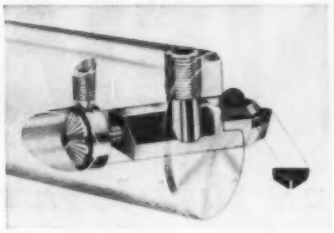
Injection type hand cutting torch designed for use with propane and natural gas announced by Air Reduction Sales Co., a Division of Air Reduction Co., Inc., New York City. Known as the Airco 2000 Series, these torches have an "ease-on" cutting-oxygen valve which allows smooth and gradual increase of the oxygen flow. This is particularly helpful in hole piercing, rivet washing, and stay-bolt cutting. The torch head is a machined

silicon-bronze forging. The brass gas tubes are arranged in a triangular group to provide rigidity and strength. The mixer housing is a machined brass forging which is fed by two short tubes, one for fuel gas and the other one for preheat oxygen. The rear end is a brass forging. Inlet connections will accommodate 1/4-, 5/16-, or 3/8-inch hose.

Circle Item 615 on postcard, page 181

"MicroDex" Boring Unit

Boring unit named the "MicroDex," for use with throw-away inserts, brought out by Valenite Metals, Royal Oak, Mich. Its outstanding feature is the combination of micro-adjustment with the use of throw-away inserts. This results in considerable cost savings on boring jobs by elimination of tool grinding and resharpening, and a substantial reduction in machine down time. These benefits are said to have been demonstrated on many production jobs, especially ones requiring tooling



for large, multiple-station, automation equipment. The new boring units have an extremely rigid and compact locking arrangement which does not reduce the strength of the boring-bar in the mounting.

Circle Item 616 on postcard, page 181

Rivett High-Pressure Hydraulic Valve

One of a line of 3000-psi hydraulic valves manufactured to meet all JIC requirements by Rivett Incorporated, Boston, Mass. It is designed to fill the need for above-average pressures in manufacturing processes where machinery has been automated. Known as Model 6100, the valve is sub-plate mounted and manually controlled by a lever. Available in five actions: (1) moved manually to either end position; (2) moved manually to "IN" position and spring-offset to "OUT" position; (3) moved manually to "OUT" position and spring-offset to "IN" position; (4) spring centered; and (5) ball detent where valve piston is held in either end position by detent. Available in seven basic spool designs and in sizes from 1/4 inch to 2 inches.

Circle Item 617 on postcard, page 181

(This section continued on page 202)

New ROL-PAK slips over dispenser rail, tape strips off in seconds. Printed, color-coded tapes identify ring type and size. All or part of ROL-PAK may be used at one time.

Old stack-rod set up requires two hands. Uses up valuable production time.

New ROL-PAK set up is far simpler and quicker; requires only one hand.

New Truarc ROL-PAK speeds ring assembly, handling

ROL-PAK* is a new method of pre-stacking retaining rings for faster, more economical assembly on production lines. Pre-stacked on a color-coded tape, the rings are quickly identified by type and size. Available to users of Truarc Retaining Rings exclusively, ROL-PAK provides production flexibility, and allows faster and more efficient assembly set-up.

On your production line, ROL-PAK slips over the dispenser rail ready to use. The pressure sensitive tape is stripped off in seconds. With the old stack-rod packaging, by contrast, an operator had to remove the cotter pin, hold the bottom rings on the rod to prevent their slipping off then carefully position the rod on the dispenser rail . . . a much more time consuming, less-efficient method.

Here are important ROL-PAK advantages for you to consider: *Faster assembly* because of quicker, easier loading as illustrated above. *Easier identification* of ring size and type, right on the printed, color-coded tapes. *Greater flexibility* since all or part of ROL-PAK may be used. *Easier handling, storage* with no protruding stack-rods.

ROL-PAK is available in Truarc Series 5103 Crescent® rings, 5133 E-rings and 5144 Reinforced E-rings in most widely used sizes. All present types of Truarc ring dispensers may be easily converted to ROL-PAK.

The design advantages of Truarc retaining rings, have led to their ever increasing use in production of products of all kinds. The new Waldes Truarc Assembly Tool Catalog AT 10-58 covering assembly tools, pliers, applicators, dispensers and grooving tools belongs in your files—write for it. And on special application problems, Waldes Truarc engineers will be glad to help. Waldes Kohinoor, Inc., 47-16 Austel Place, Long Island City 1, N. Y.

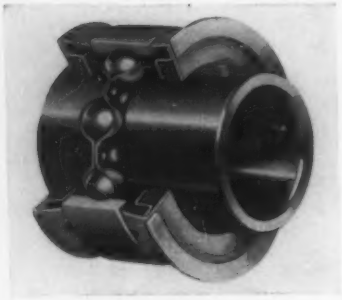
*Pat. Pending ©1959 WALDES KOHINOOR, INC. 9.10

WALDES TRUARC® RETAINING RINGS

Waldes Kohinoor, Inc., Long Island City 1, N. Y.

TRUARC RETAINING RINGS...THE ENGINEERED FASTENING METHOD FOR REDUCING MATERIAL, MACHINING AND ASSEMBLY COSTS

For more data, circle this page number on inquiry card



Ball-Bearing Unit for Machine Applications

Simplex machine unit bearing, quality-made, yet simply constructed to meet the low-cost requirements of many applications, introducted by the Hoover Ball & Bearing Co., Ann Arbor, Mich. Designed for light loads at normal speeds, the unit includes a single-row bearing of deep-groove design with extended inner ring, equipped with two set-screws for locking the bearing on its shaft. Separable seals may be used either singly or on both sides of the bearing. A wire lock ring holds the entire unit securely in its straight-bore housing. Bearings are available in shaft sizes from 1/2 inch through 1 3/16 inches. These new units are made with extra-smooth "Hoover Honed" raceways and high-quality "Micro-Velvet" balls.

Circle Item 618 on postcard, page 181

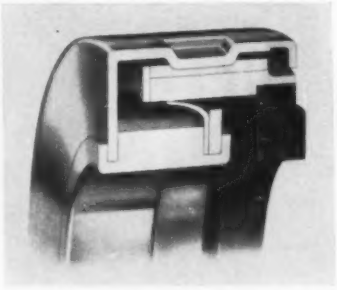
"Rol-Pak" for Stacked Retaining Rings

Truarc "Rol-Pak" developed by Waldes Kohinoor, Inc., Long Island City, N. Y. This pressure-sensitive tape wrapper replaces a metal stack-rod and cotter-pin formerly used to stack Truarc retaining rings for assembly with the company's applicators and dispensers. The tape extension at the top permits the wrapper to be removed in a single downward motion (see illustration). Rol-Pak is available for Truarc Series 5103 crescent rings, Series 5133 E-rings, and Series 5144 reinforced E-rings.

Circle Item 619 on postcard, page 181

Gits "Met-L-Seal"

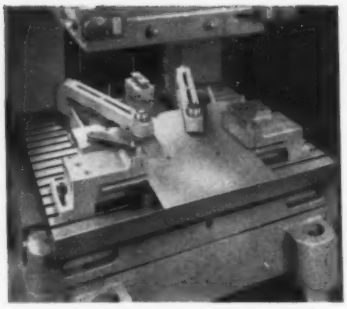
"Met-L-Seal" all-metal shaft seal that functions at temperatures ranging from —65 to +850 degrees F., designed and produced to achieve "missile reliability" by the Gits Bros. Mfg. Co., Chicago, Ill. This seal is designed to operate at temperatures even higher than 850 degrees F., the temperature being limited only by metallurgical progress in high-temperature alloy steels. All components, except the seal face, are made of various high-temperature alloy steels, each with the optimum combination of properties necessary to its function. Face materials are of carbon graphite or various exotic alloys. Hydraulic balance produces optimum sealing with both static and dynamic conditions.



Circle Item 620 on postcard, page 181

Wales-Strippit Line of T-Slotted Plates

T-slotted plates with a number of improvements made possible through new manufacturing techniques, announced by Wales-Strippit, Inc., Akron, N. Y. The plates are designed for mounting setups of independent Strippit punching and notching units as well as many other press and press-brake requirements. Illustration shows the T-slotted plate set up with 90-degree corner-notching units, hole-punching units, edge notcher, and stops. Strippit T-slotted plates are now special, low-carbon rolled steel, and (except for extremely large sizes) finish-ground top and bottom. This results in higher-quality plates of closer tolerances and greater durability than with the previously cast plates. It also allows Strippit to offer a greater selection of stocked sizes in 12-, 18-, 24-, and 30-inch widths.



Circle Item 621 on postcard, page 181

Calibrated Turning Head

This "Master Turner," featuring quick setup and a direct-reading scale for depth of cut from 1/4 to 1 inch, is being manufactured by the Patt Brothers Co., Willoughby, Ohio. It is an accurate, adjustable turning head designed for fast, short-run production on screw machines and similar equipment. The four-lip cutter is designed to provide four times the usual cutting life. Both supporting rollers and cutter are equally and simultaneously adjusted to the desired diameters by a ring cam.

Circle Item 622 on postcard, page 181

How a leading automotive manufacturer Snyder-izes for the Soaring Sixties

HOLDS PISTON WEIGHTS ± 2 GRAMS AT 600 PER HOUR

This Snyder transfer machine automatically weighs die cast aluminum pistons and mills them to tolerances of ± 2 grams at double the rate of the previous method. Here's how it turns out 600 parts per hour:

Pistons are transferred bottoms-up to orienting station.

Pistons are oriented in relation to the wristpin hole offset.

Pistons are spun right side up (below at right) while they are advanced to weighing station.

Precise overweight is transmitted by memory system to weigh-mill station during transfer.

A 3¼" milling cutter removes excess with the piston clamped in position.

Gaging station re-weighs pistons to check weight. Deviation from part tolerances stops machine.

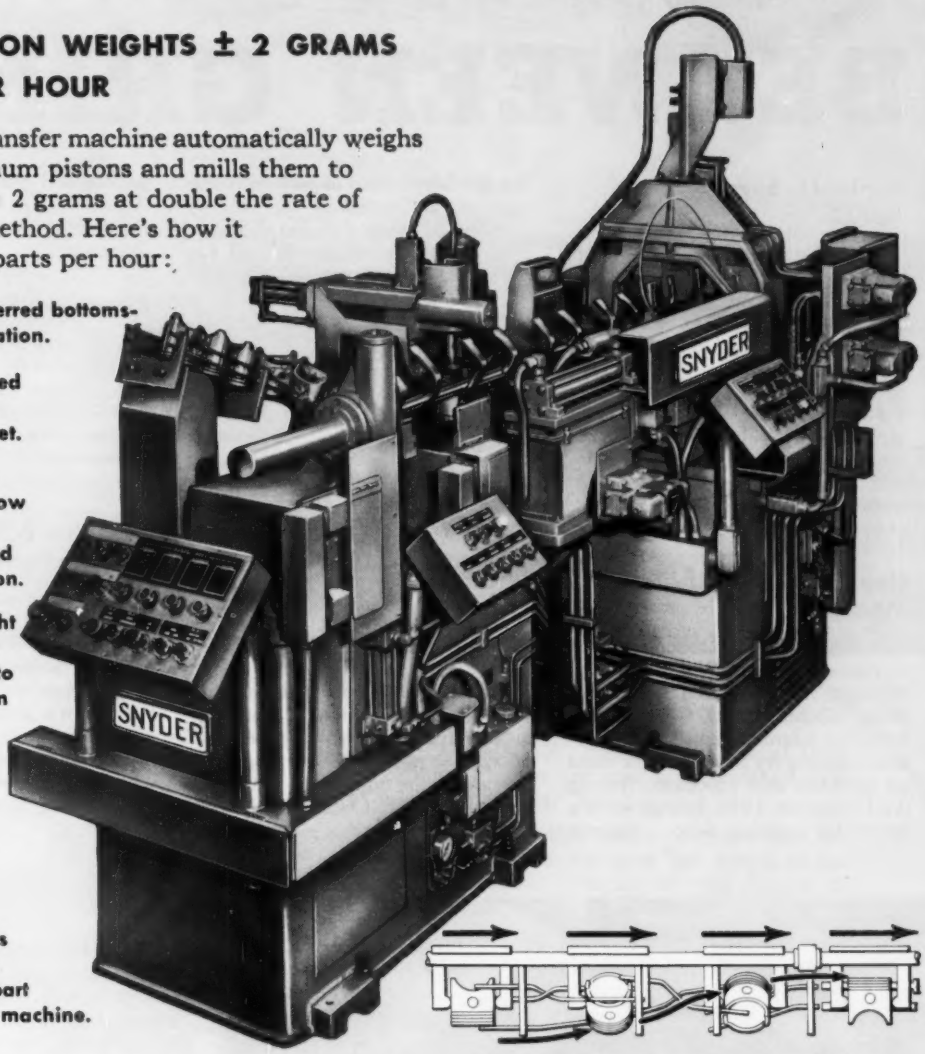
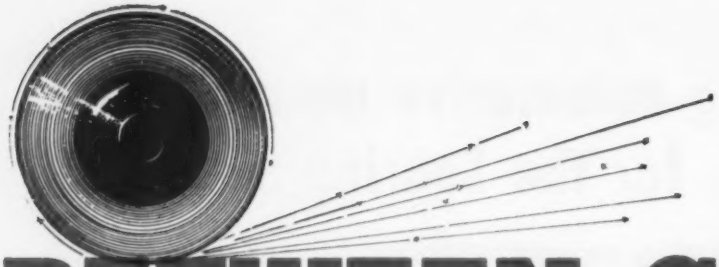


Diagram shows end over end rotation of piston as it passes through spiral rails.

Do your manufacturing cost problems revolve around parts handling, gaging and assembly as well as machining? Ask us to show you the benefits of SNYDER-IZING FOR THE SOARING SIXTIES. For a resume of SNYDER special machines engineered for profit opportunities, send for our new brochure or phone.

SNYDER
CORPORATION
(Formerly Snyder Tool & Engineering Company)
3400 E. LAFAYETTE—DETROIT 7, MICHIGAN
Phone: LO 7-0123

For more data, circle this page number on inquiry card



By E. S. Salichs

BETWEEN GRINDS

ComeALL, Says DoALL

"The Cutting Edge," a film prepared by the DoALL Co. for engineering and technical groups across the nation, consists of a historical panorama showing 1,000,000 years of progress in man's application of cutting edges; an illustrated talk on up-to-the minute cutting-tool principles; and a side exhibit of actual tools, work-pieces, and technical data. The program is under the direction of Mr. C. G. Schelly, Director of Educational Research.

Opportunities by the Month

A Products-List Circular, No. 39, is released monthly by the Small-Business Administration (Lafayette Bldg., Washington, D. C.) for distribution to interested small firms, possibly opening up new fields for them on products and processes. Among the December, 1958, listings were a device for inducing sleep; a process for the dehydration of biological substances; an apparatus for the collection and cooling of blood; a new type of toy flying saucer; and two foreign-owned inventions granted U. S. patents.

Wavewashed

An ultrasonic sink to clean clothes with sound waves was featured by Westinghouse in a recent demonstration at the company's Research Laboratories, an innovation made possible by an improved ultrasonic transducer. Interpret the sound waves emitting from our sink and you would still hear the cry, "How do they get their jeans so dirty!"

Thoughts on Thorium

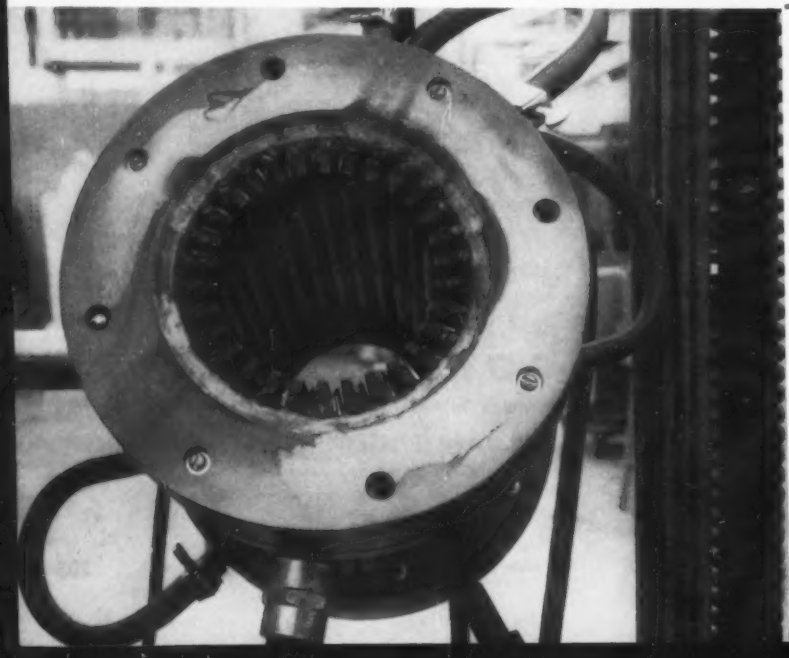
Thorium, an element under consideration as an additional source of nuclear fuel for atomic power, is a radioactive material. Because of this, it became the subject of the latest in a series of Chemical Hazards Bulletins ("Thorium – Its Compounds and Alloys") prepared by the Accident Prevention Department of the Association of Casualty & Surety Companies.

Revved-up Research

Sentiment in the "Hot Rod Handbook," recently published, is that many engineering refinements of automobile manufacturers stem from the painstaking work done by eager, oil-smeared hot rodders in barn-to-garage-converted workshops.

Herd that Bellows Now Mellows

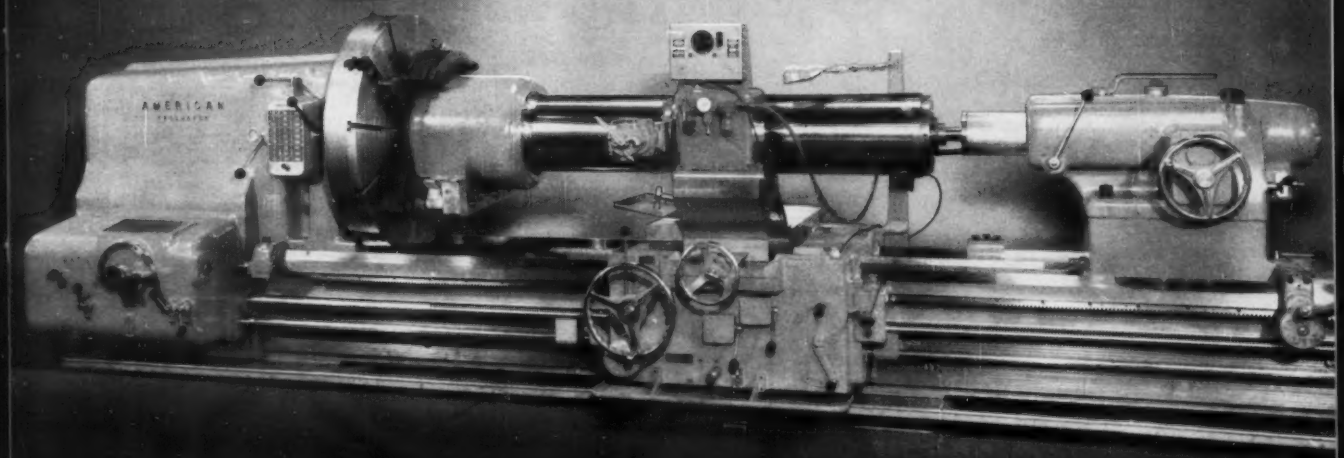
An experiment was recently performed during which thirty-four food editors voted that steaks from tranquillized steers tasted better than steaks from *un*tranquillized steers. So now it's Miltowns for meat. No *obvious* connection, but this reminds us that we just read about five ladies who have formed a car pool to take turns driving to their psychoanalysts in town.

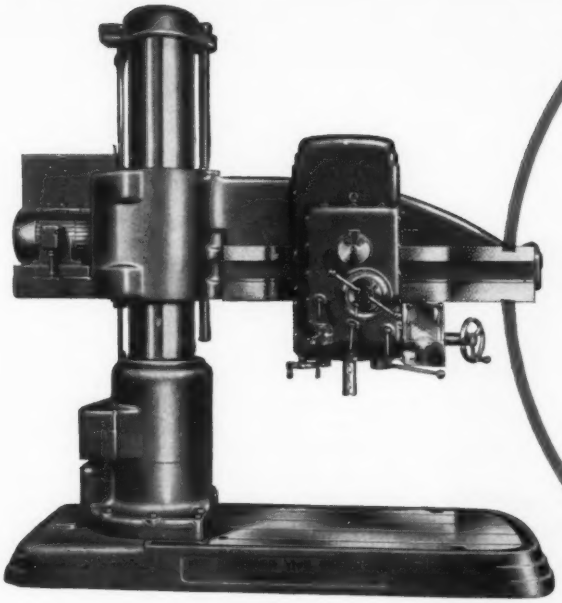


INSTANT HIGH HEAT—The advent of the Space Age has made it mandatory to perform all sorts of laboratory tests at elevated temperatures. To meet this need, engineers at the Boeing Airplane Co. developed the quick-heat furnace seen here, which will reach 3500 degrees F. in ninety seconds. By arranging thirty lamps in a circle with a copper water-jacket cooling system around them to prevent melting, standard lamps are operated at over twice the manufacturer's rating, the power being jumped from 1000 to 2700 watts per lamp. The inner surface of the furnace is gold-plated for better heat reflection.

MIRROR FINISH

. . . that Reflects not only LIGHT . . . but QUALITY





All "AMERICAN" Hole Wizard Radial Drill Column Sleeves are now super-finished to a beautiful "mirror" finish.

Not only does this vastly improve the appearance of the machine but which is far more important it minimizes the danger of column cutting and scratching.

This operation is done in our own plant on a brand new 40" "AMERICAN" Pacemaker Lathe equipped with a new No. 4 Gisholt Super-finishing attachment.

This represents just another step along the path of continuous modernization to improve the quality and also the inherent value of "AMERICAN" Lathes and Radial Drills.

Descriptive bulletin No. 328 will be of interest to you. It illustrates and describes many new and exclusive features.

THE AMERICAN TOOL WORKS CO. Cincinnati 2, Ohio, U. S. A.

LATHES AND RADIAL DRILLS

News OF THE INDUSTRY

California and Texas

PAUL V. BROWN has been appointed manager—manufacturing of the La Verne, Calif., plant of Taylor Fibre Co., Morristown, Pa. The plant is the only one on the West Coast making industrial high-pressure laminated plastics.

John A. Houston, general manager of the Dallas plant, Joseph T. Ryerson & Son, Inc.

JOHN A. HOUSTON has been appointed general manager of the Dallas, Texas, plant of Joseph T. Ryerson & Son, Inc. Mr. Houston entered the sales department in 1935, becoming a sales representative in 1940. After filling other assignments, in October of 1958 he became assistant general manager of the firm's Philadelphia plant.

Illinois, Indiana, and Wisconsin

CLEARING, a division of U. S. Industries, Inc., Chicago, Ill., announces new engineering and management appointments. ASA SNYDER has been appointed director of research and development. Mr. Snyder comes to Clearing with a broad background in research. THOMAS BANNON has been promoted to director of Production Engineering. JOHN CAMERON has been appointed assistant chief engineer in charge of technical services. A Staff Engineering Section has been formed to operate at a supervisory level. The following people have been appointed to this Staff: RAY STEJPHAL becomes senior staff engineer; LOU CARRIERI becomes staff hydraulic engineer; BARNEY BENDICSEN becomes staff electrical engineer. GAIL NAVIS was named staff assistant, with the responsibility of coordinating engineering schedules with manufacturing. JOHN R. MCCUTCHEN has joined the company in the capacity of hydraulic application specialist. The appointment of KINGSLEY C. DRONE as chief engineer of the Aircraft & Missile Division of Clearing Machine Corporation was also announced. Further miscellaneous activities include the following: Clearing Division has completed arrangements whereby it will sell and service English-made lathes throughout the United States and Mexico. Clearing, hereafter, will be exclusive American representative for a new line of lathes, called the Clearing-Harrison line, manufactured by T. J. Harrison & Sons, Ltd., Heckmondwike, Yorkshire, England. In Mexico, this line will be handled by USI's Mexican subsidiary, USI de Mexico, S. A.

Asa Snyder, director of research and development, Clearing, a division of U. S. Industries, Inc.

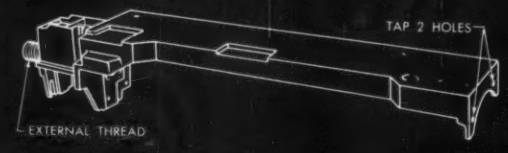
Robert M. Miller, newly elected vice-president and general sales manager, Onsrud Machine Works, Inc.

ROBERT M. MILLER has been promoted to vice-president and general sales manager of Onsrud Machine Works, Inc., Niles, Ill. He will be responsible for marketing and direction of sales for all company divisions.

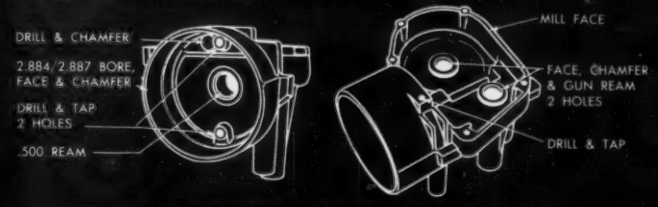
STANDARD SCREW CO., Bellwood, Ill., has announced the election of JAMES A. TAYLOR as new president of its coast to coast operations. Mr. Taylor succeeds W. D. CORLETT, who advances to chairman of the board. Other re-elected officers include vice-presidents E. L. CLAUSSEN, A. D. ROSE, and K. H. DALY. Mr. Claussen directs Stanscrew fastener sales, Mr. Rose is in charge of manufacturing, and Mr. Daly is general manager of Standard's division and plant in Elyria, Ohio—the Western Automatic Machine Screw Co. As president of Hartford Machine Screw Co., Mr. Taylor will continue to direct activities of this Standard division and plant in Hartford, Conn. Mr. Corlett will do likewise for the Chicago Screw Co. Division, Bellwood, Ill. Additional divisional headquarters and plant facilities under their supervision are Ravenna Metal Products, Seattle, Wash.; Hartford-Greenville, Green-

(*Continued on page 212*)

Ready to produce and produce and produce



SPEEDOMETER FRAME



WINDSHIELD WIPER HOUSING

These two machines are shown on our assembly floor ready to ship. One is a simple double-end machine with no indexing, the other a large center-column machine with indexing.

Both machines operate on die castings at high production rates. Both have power clamping and unclamping. Each operator removes a finished part, puts a new one in the fixture and presses buttons to clamp it.

The customers approved test runs here on our assembly floor. They continue to get good production because of good basic design and rugged, accurate construction.

Speedometer Frame 600 parts per hour is the gross production on the double-end machine (left). The left unit threads a stem with a self-opening die head while the right unit taps two holes. Another Kingsbury (not shown) operates on 11 holes in the same part.

Windshield Wiper Housing 460 parts per hour is the gross production on the big 13-spindle machine. A 43-inch index table holds seven work fixtures. The face to be milled is on top.

The first unit at the man's left mills the face at 3500 rpm. It is 30° right of the radial centerline through the station. For the holes in the center sketch there are four horizontal units, each 60° left of the radial centerlines.

Four vertical units operate on holes in the right sketch. A combination tool machines the .500 hole and 2.884 bore concentric within .003 T.I.R.

Special features include —

— Filtered coolant for all tools and gun reaming of two holes for a high finish.

— Oil mist lubrication for the multi-spindle auxiliary heads.

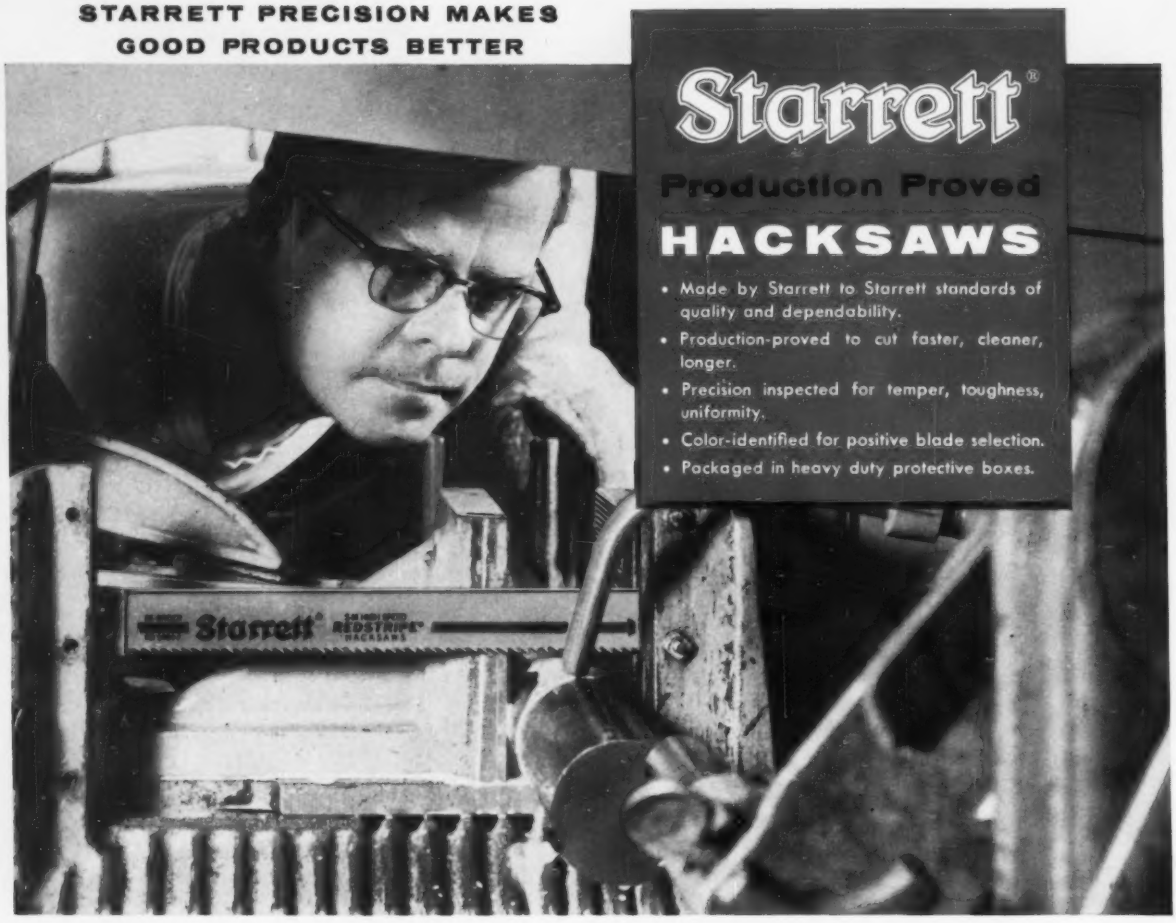
— Lights that identify any unit that fails to complete its cycle.

Little downtime, few rejects Our customers tell us that their Kingsburys run month after month without trouble. A Kingsbury can do the same for you. Kingsbury Machine Tool Corp., Keene, New Hampshire.

KINGSBURY

MULTI-UNIT AUTOMATICS

STARRETT PRECISION MAKES GOOD PRODUCTS BETTER


Starrett
Production Proved
HACKSAWS
• Made by Starrett to Starrett standards of quality and dependability.
• Production-proved to cut faster, cleaner, longer.
• Precision inspected for temper, toughness, uniformity.
• Color-identified for positive blade selection.
• Packaged in heavy duty protective boxes.
Starrett
REDSTRIPE
HACKSAWS

Watch your cutting costs go down when you specify STARRETT *PRODUCTION PROVED* HACKSAWS

You know in advance what Starrett hacksaws will do. Each blade type has been developed for a specific range of cutting jobs, thoroughly *production-proved*, manufactured to Starrett quality standards and *clearly color-identified to simplify correct blade selection.*

Years of saw making experience and development research are summed up in this simple color code that lets shop men select Starrett hacksaws the way they select metals — each matched to the job at hand. By specifying *Starrett* when you buy hacksaw blades, you get production-proved performance that makes cutting costs go down.

Your nearby Industrial Supply Distributor has them. Call him for quality products, dependable service. Or write for Starrett Saw Catalog. Address Dept. D, The L. S. Starrett Company, Athol, Massachusetts, U. S. A.

THE RIGHT BLADES FOR LOW COST, FAST CUTTING, LONG LIFE

STARRETT REDSTRIPE® SM — high speed power and hand blades specially tempered for cutting hard materials with heavier speeds and feeds.

STARRETT GREENSTRIPE SAFE-FLEX® — high speed hand and welded edge power blades — shatterproof, unbreakable, the safest blades for heavy feeds, gang sawing, interrupted cuts.

STARRETT BLUESTRIPE — selected high speed steel power and hand blades especially heat treated for high speed production sawing and hard-to-cut metals.

Starrett®
PRODUCTION PROVED
HACKSAWS
World's Greatest Toolmaker

STARRETT TOOLS

PRECISION TOOLS • DIAL INDICATORS • STEEL TAPES • GROUND FLAT STOCK • HACKSAWS • HOLE SAWS • BAND SAWS • BAND KNIVES

Visit the Starrett Exhibit, BOOTH 420, Quality Control Show, Cleveland

AMERICAN STANDARD DRIVING AND SPINDLE ENDS FOR PORTABLE AIR AND ELECTRIC TOOLS—1

(Percussion Tools Excluded)

Approved as American Standard October 29, 1958

I. Scope

This standard applies to portable power tools for drilling, grinding, polishing, sawing, and driving threaded fasteners. Other tools not classed as percussion tools belong in this category and may be added by revision or addition through the usual procedure. This standard includes dimensions and tolerances for both driving and driven elements where such coordination is important and not established by reference to the pertinent American Standards. All dimensions are in inches.

Greater interchangeability of tool parts for portable power tools is the purpose of this new American Standard, designated B5.38-1958. The data on threaded and tapered spindles given on this and the following page, and data covering other types of spindles and fastenings to be published in succeeding issues of MACHINERY, have been approved by the American Standards Association and published by the American Society of Mechanical Engineers. This standard applies to portable power tools that are used widely in construction, shipbuilding, and other industries where the work cannot be taken into the machine tool shop. The tools are also frequently used on mass-production assembly lines.

The new standard includes dimensions and tolerances for both driving and driven elements where such coordination is important and not established by reference to other pertinent American Standards. Tool parts covered include spindles for geared chucks, threaded-fastener drives—including hexagonal and square drives—abrasion-tool spindles, and circular-saw arbors.

Joint sponsors of American Standard B5.38-158 are the Metal Cutting Tool Institute, the Society of Automotive Engineers, the National Machine Tool Builders' Association, the American Society of Tool Engineers, and the American Society of Mechanical Engineers.

The committee working on the development of this standard kept close liaison with the Electric Tool Institute, the Compressed Air and Gas Institute, the Service Tools Institute, the Grinding Wheel Institute, and other organizations concerned with the subject matter.

II. Spindles for Geared Chucks

1. Threaded Spindles

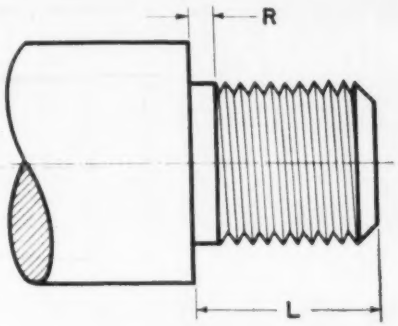


Table 1

Nominal Dia. and Thread	Pitch Dia. Max.	Pitch Dia. Min.	*R*	*L*
3/8 – 24	0.3479	0.3455	1/16 ± 1/64	9/16* $^{+\ 0.000}_{-\ 0.030}$
1/2 – 20	0.4675	0.4649	1/16 ± 1/64	9/16 $^{+\ 0.000}_{-\ 0.030}$
5/8 – 16	0.5844	0.5812	3/32 ± 1/64	11/16 $^{+\ 0.000}_{-\ 0.030}$
3/4 – 16	0.7094	0.7062	3/32 ± 1/64	11/16 $^{+\ 0.000}_{-\ 0.030}$

All dimensions given in inches.

*Also 7/16. Dimensions in inches and threads per inch right hand. For recommended chuck correlation, see Appendix A, to be published in a later data sheet.

Extracted from American Standard Driving and Spindle Ends for Portable Air and Electric Tools (ASA B5.38-1958), with permission of publisher, the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.

AMERICAN STANDARD DRIVING AND SPINDLE ENDS FOR PORTABLE AIR AND ELECTRIC TOOLS—2

(Percussion Tools Excluded)

Approved as American Standard October 29, 1958

II. Spindles for Geared Chucks (Cont'd.)

2. Tapered Spindles (Jacobs)

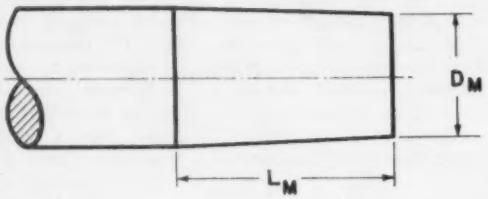


Table 2

Number*	D_M	L_M	Taper Per Foot
1	0.335-0.333	0.656	0.92508
2 Short	0.490-0.488	0.750	0.97861
2	0.490-0.488	0.875	0.97861
33	0.563-0.561	1.000	0.76194
6	0.626-0.624	1.000	0.62292
3	0.748-0.746	1.219	0.63898

*Jacobs number. For recommended chuck correlation, see Appendix A, to be published in a later data sheet. All dimensions given in inches.

3. Master Plug Gage Dimensions

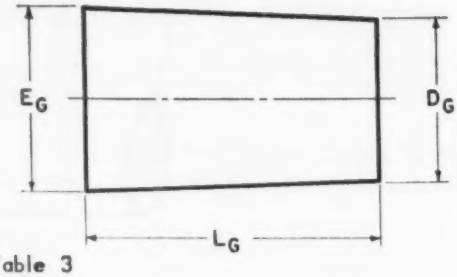


Table 3

Jacobs Tapers

Number	E_G	D_G	L_G	Taper Per Foot*
1	0.38400	0.33341	0.65625	0.92508
2 Short	0.54880	0.48764	0.7500	0.97861
2	0.55900	0.48764	0.87500	0.97861
33	0.62401	0.56051	1.000	0.76194
6	0.67600	0.62409	1.000	0.62292
3	0.81100	0.74610	1.21875	0.63898

*Calculated from E_G, D_G, and L_G. All dimensions given in inches.

Extracted from American Standard Driving and Spindle Ends for Portable Air and Electric Tools (ASA B5.38-1958), with permission of publisher, the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.

This Ex-Cell-O Bushing should outlast 2 of the kind you are now using . . .

58-5

POSITIVE PROOF! EX-CELL-O BUSHINGS GIVE TWICE THE AVERAGE BUSHING LIFE

Recent plant-wide bushing life tests, conducted by a large heavy implement manufacturer, established this astonishing proof of Ex-Cell-O superiority: they lasted more than *twice* as long as the next best bushings on the market.

After drilling 16,300 test holes, the competitive bushing showed an average .0039" of wear—ready for scrap—while Ex-Cell-O bushings averaged only .0017" of wear, less than *half* as much!

As a cost-conscious competitive manufacturer, you owe it to yourself to investigate the very substantial savings Ex-Cell-O bushings offer. Test them against any, or all, competitive bushings right in your own plant.

Send your order to Ex-Cell-O Corporation at Detroit, New York, Downey, Cal., Lima, Ohio, and London, Canada. You'll get immediate shipment. Write for an Ex-Cell-O Drill Jig Bushing Catalog today.

EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN

EX-CELL-O FOR PRECISION

XLO

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING AND BORING SPINDLES CUTTING TOOLS • TORQUE ACTUATORS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

ville, S. C.; and the Western Automatic Machine Screw Co.

SUPER TOOL CO., Detroit, Mich., a subsidiary of Van Norman Industries, plans to have in operation, within the next two months, a major warehouse center in the Chicago area. The warehouse will insure faster cutting tool deliveries to both industrial plants and cutting tool distributors within a 300-mile radius of the city.

John R. Keates, newly elected vice-president in charge of sales, National Automatic Tool Co.

JOHN R. KEATES has been elected vice-president in charge of sales of the National Automatic Tool Co., Richmond, Ind. Mr. Keates was formerly general manager of "Natco's" Machine Tool Division. He first became associated with the company in 1935 as a sales engineer and in 1957 was appointed general sales manager, after serving Natco in different areas of the country.

MACHINE TOOL AFFILIATES, 54 W. 30th St., Indianapolis 8, Ind., has been appointed by the THOMPSON GRINDER CO., Springfield, Ohio, as its exclusive distributor in Indiana for the complete Thompson line.

KEARNEY & TRECKER, Milwaukee, Wis., have established a Contract Division to handle all types of subcontract work for other industries. The Kearney & Trecker Contract Division will operate from Milwaukee through the company's direct sales offices located in principal industrial cities. ELMER H. BEHRENS has been named sales manager, and JOHN P. BUNCE, manufacturing manager, of the Contract Division.

Michigan and Missouri

STERLING SUPPLY CO., 1220 E. Nine Mile Road, Ferndale, Mich., has been appointed as an industrial cutting tool representative of Super Tool Co., division of Van Norman Industries, Detroit, Mich. The new distributor will carry a complete inventory of the Super Tool line and also will be prepared to aid manufacturers in the Detroit, Pontiac, and Ann Arbor areas.

HEIDRICH TOOL & DIE CORPORATION, Detroit, Mich., announces the following personnel changes: RUDOLPH HEIDRICH, founder, and president since 1937, has retired from the company. He has been succeeded as president by JACK SLEAN, who continues as general manager. General plant superintendent JULIUS A. SCHENSKY has become vice-president—maufacturing. HAROLD O. LOVE is now vice-president and general counsel and PERRY G. ABBOTT is secretary-treasurer.

PANGBORN CORPORATION, Hagerstown, Md., announces the appointment of two abrasives sales engineers, ALEXANDER J. SZABO, who joined Pangborn in 1955, and ROBERT D. ROSE, who recently joined the company. Both men will be headquartered at the Pangborn district sales office, 1012 Stephenson Blvd., Detroit, Mich.

WESSON CO., Detroit, Mich., has announced the election of three new vice-presidents, all of whom are district managers. The three—SY DWORECKI, Chicago; JAMES J. SMITH, JR., East Paterson, N. J.; and GERALD BOGNER, Cleveland—have been with Wesson for a combined total of thirty-seven years.

THE CUTTING TOOL DIVISION of Brown & Sharpe Mfg. Co. announces the opening of another Cutter Service Co. in Michigan. The latest addition to distributor and customer service is located in the Double A Valve plant of the Hydraulics Division located at East Duncan St., Manchester, Mich.

THREADWELL TAP & DIE CO., Greenfield, Mass., announces the appointment of NORMAN ABRAM WISMER as representative for its complete line of cutting tools in the Michigan area. Mr. Wismer operates as a manufacturers' representative out of his home at 2369 N. 112th St., Grand Rapids, Mich.

Vickers Incorporated, Detroit, Mich. announces that ARTHUR H. VAN WORMER has been appointed sales manager, Industrial Products Department, by the Machinery Hydraulics Division of the company. The new district manager of Vickers' Detroit Industrial Sales Office is JACQUES CARPENTER.

CLEARING, division of U. S. Industries, Inc., Chicago, Ill., announces the appointment of PRESS EQUIPMENT SALES to be their local dealer in metropolitan Detroit for open-back inclinable, horning, and single-crank gap presses up to 200 tons capacity.

HARRY TIFFANY has been appointed head of Special Products for Sahlin Engineering Co., Birmingham, Mich.

WARREN G. BRUNS has been named district manager of the St. Louis, Mo., office of the Pratt & Whitney Co., Inc.

New England

PRATT & WHITNEY CO., INC., West Hartford, Conn., announces that it has been named an official sales agency for the line of precision lathes manufactured by the Wade Tool Co., Waltham, Mass. Wade lathes will be made available through P & W factory-direct representatives working out of P & W branch offices located in principal cities throughout the country.

E. C. BULLARD, chairman of the board of the Bullard Co., Bridgeport, Conn., announced that he would relinquish his duties as chief executive officer of the company to E. P. BULLARD III, president, on March 31, 1959. Mr. Bullard, who has served in the company for the past forty years, will continue as chairman of the board of directors, a post to which he was elected in June of 1957.

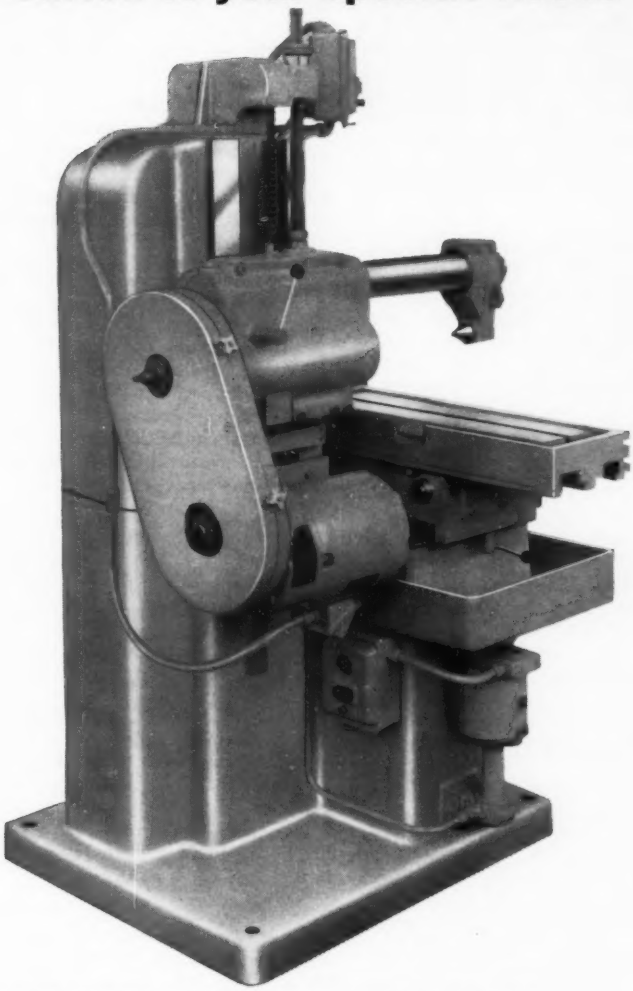
EASTERN MACHINE SCREW CORPORATION, New Haven, Conn., announces that CHARLES W. WESSON was elected president of the corporation and CARL W. BETTCHER, the former president, was elected chairman of the board of directors.

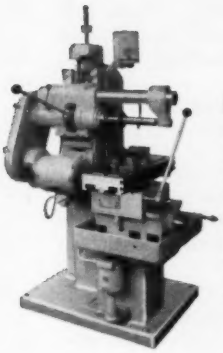
HARRY C. LEVENSON has been appointed by Landers, Frary & Clark, New Britain, Conn., to the position of assistant to the president in charge of manufacturing operations of the subsidiary companies of the corporation.

THE POTTER & JOHNSTON CO., subsidiary of Pratt & Whitney Co., Inc., will move all operations from

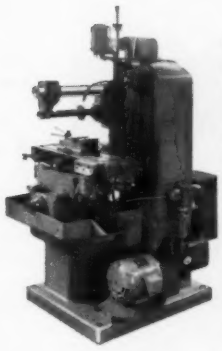
A NEW HEAVY-DUTY BED MILLER

with 3 standard arrangements suited to your specific needs

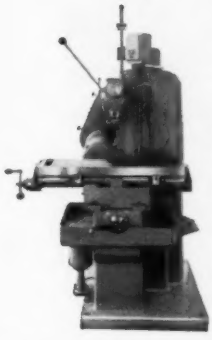




MODEL 1A
for economy on small lot production work. Table work surface 9-13/16" x 27", single T-slot, lever feed. Micrometer table stops, micrometer cross adjustment of saddle.



MODEL 1B
with Hydraulic Feed, for longer production runs. Two milling tables available: 9-13/16" x 27" (single T-slot), hydraulic lever control for rapid approach, feed and return; and 9-13/16" x 32" (3 T-slots), electrical push-button control for rapid approach, feed and return (automatic).



MODEL 1C
for low production and toolroom work. Large table work surface, 9-13/16" x 32", 3 T-slots. Handwheel screw feed, extra-large micrometer dial.

Rugged, oversize, extra-heavy components throughout

- Unit construction for flexibility
- Extra-wide table for easy mounting of large fixtures (two table lengths avail.)
- Tooth-belt spindle drive for full h.p. transmission
- Heavy-duty saddle
- Heavy-duty steel base
- Push-pull selector switch
- Extra long ways provide exceptional milling head rigidity
- Solid, extra-large (3" dia.) overarm and arbor support
- Hardened and ground box type table ways
- Micrometer adjustments, vertical, horizontal, transverse
- Six spindle speeds in two ranges: 111 to 1105 rpm and 247 to 2463 rpm
- 1 HP geared head motor (or 1½ HP)

SEND FOR DETAILED FREE BULLETIN. Your inquiry into the use of this versatile machine for your needs will receive prompt attention.
THE PRODUCTO MACHINE COMPANY, BRIDGEPORT 1, CONNECTICUT.

PRODUCE MORE WITH

PRODUCTO

MACHINE TOOLS

BED MILLERS, ROTARY AND LINE TRANSFER MACHINES, AUTOMATIC INDEX PRODUCTION MILLERS, SPECIAL MILLING MACHINES

For more data, circle this page number on inquiry card

Pawtucket, R. I., to the plant of the parent company in West Hartford, Conn. Its new mailing address will be Potter & Johnston Co., Charter Oak Blvd., West Hartford 1, Conn.

KENNETH M. CHAKIRIS has been appointed sales manager for the Horton chuck line of Geometric-Horton Division of United Greenfield Corporation. He will have his headquarters at the Geometric-Horton plant in New Haven, Conn.

ANDERSON OIL & CHEMICAL CO., INC., has just completed a major expansion of plant facilities in Portland, Conn.

John J. Hayes, president, Morse Twist Drill & Machine Co.

JOHN J. HAYES has been elected president of the Morse Twist Drill & Machine Co., New Bedford, Mass., a division of Van Norman Industries, Inc., it was announced recently by CHARLES F. MYERS, president of Van Norman. Mr. Hayes succeeds to the position vacated when Mr. Myers assumed the Van Norman presidency. Mr. Hayes has been with Van Norman Industries in various supervisory positions for fifteen years.

JOSEPH T. RYERSON & SON, INC., Boston, Mass., has announced the following changes in sales management at the Boston plant. JOSEPH A. MORAN has been named sales manager, and ARTHUR B. BURKE and NAPIER B. CALDWELL have been appointed district sales managers. Mr. Moran has been given over-all responsibility for all sales activities, while Mr. Burke and Mr. Caldwell will each direct sales work in selected sales districts.

WYMAN-GORDON CO., Worcester, Mass., has created several new posts. The posts, and men named to fill them, are general manager—Eastern Division (consisting of Worcester and North Grafton plants), JOSEPH R. CARTER; and general manager—Harvey, Ill., plant, ROBERT E. ZELL.

WARREN L. HARDY has been appointed manager of marketing research for abrasive products at Norton Co., Worcester, Mass.

MADISON-FAESSLER TOOL CO. has moved its manufacturing operations from Moberly, Mo., to Providence, R. I., where the company will have larger and completely modernized plant facilities adjacent to its associated companies, Madison Industries, Inc., and Madison-Relco Tool Co.

ARNOLD N. HELLEWELL of BROWN & SHARPE MFG., CO., Providence, R. I., has been appointed sales director for turret drilling machines. This line, along with jigless work positioning devices, was recently acquired through the company's purchase of Howe & Fant, Inc., of East Norwalk, Conn.

FELLOWS GEAR SHAPER CO., Springfield, Vt., announces that headquarters of general sales manager GEORGE H. SANBORN and assistant general sales manager STEWART BARTON has been transferred from Detroit to the main plant in Springfield, Vt. The branch office in Detroit will be continued with A. R. TOBIN as manager.

New York and New Jersey

STANDARD GAGE CO., Poughkeepsie, N. Y., announces that GEORGE T. LOTT has been appointed as its representative in the Cincinnati area (southern Ohio and northern Kentucky). His address is George T. Lott Co., 4269 Plainville Road, Cincinnati 27, Ohio. NEWKIRK SALES CO. has been appointed as its exclusive representative in Iowa except for the four eastern counties. C. W. WRIGHT, owner, and EDWARD S. BARR, sales manager, can be reached at Newkirk Sales Co., 417 W. Fifth, Waterloo, Iowa.

BLACK & DECKER MFG. CO. announce the opening of a new factory service branch at 227 Varick St., New York City. Sales operations of Black & Decker products will continue to be maintained at the present Woodside service branch. DAN E. CALABRESE has been appointed assistant branch service manager of the company's new Manhattan branch, which is under the over-all supervision of WALTER TRAPP, B & D New York Branch service manager.

VANADIUM-ALLOYS STEEL CO., Latrobe, Pa., has announced the appointment of C. J. MCDONALL as district sales manager in New York City. Mr. McDonall succeeds H. F. DELACOUR, who is retiring after twenty-nine years' service. Mr. DeLacour plans to maintain his affiliation with the company by serving in an advisory role.

THREADWELL TAP & DIE CO., Greenfield, Mass., announces the recent appointment of JOHN J. SULLIVAN as representative for its complete line of cutting tools. Mr. Sullivan has offices at 9 Main St., Box 33, Holcomb, N. Y.

CLEARING, a division of U. S. Industries, Inc., Chicago, Ill., announces the appointment of R. H. BRITTON MACHINERY SALES, INC., to be its local dealer in central and west New York for open-back inclinable and horning presses up to 200 tons capacity. Included is the new Torc-Pac line, now available in 22-, 32-, and 45-ton capacities.

CHARLES E. ST. THOMAS, associated with General Electric Co. for the past ten years, has organized a management consulting business in New York City. The new business, St. Thomas Associates, Inc., will specialize in marketing consulting. It is located at 230 Park Ave.

LINDE COMPANY, Division of Union Carbide Corporation, New York City, announces that LAWRENCE HARVEY KISSLER has been appointed supervisor of distributor sales in the Salt Lake City district. ED STILL has been named sales representative in the San Francisco district.

WALFRID (BILL) H. JOHNSON has been appointed New York district sales manager for Western Brass, Metals Division, Olin Mathieson Chemical Corporation. Mr. Johnson will continue to be located at 29-27 41st Ave., Long Island City, N. Y.

BERNARD W. DIDSBURY has been appointed by the Farrel-Birmingham Co., Inc., Ansonia, Conn., to the position of assistant general manager of the company's Buffalo, N. Y., plant.

RAYBESTOS-MANHATTAN, INC., Passaic, N. J., recently announced that JOHN H. MATTHEWS, executive vice-president, retired from full gen-

eral management responsibilities of the Manhattan Rubber Division, Passaic, N. J. He will continue as a director of the company and as a consultant. The following Manhattan Division management organization changes were made. JOSEPH N. KUZMICK became divisional manager. Mr. Kuzmick previously was coordinator of corporation research and development activities. To assist Mr. Kuzmick, CLARENCE P. SCHNEIDER was elevated to the post of assistant to the divisional manager. Mr. Schneider has been general manager for the Wabash Division at Crawfordsville, Ind. He will make his residence again in this area and continue to supervise the activities of the Wabash Division as general manager. Two manufacturing general managers are now in charge of the production departments. ROBERT J. GORECKI and WILDER E. PERKINS assume these executive responsibilities each with title of manufacturing general manager.

PARKER-KALON DIVISION, General American Transportation Corporation, Clifton, N. J., has announced four new executive appointments. LOUIS LOVISEK, chief engineer, has been named manufacturing manager in charge of manufacturing, planning, and engineering. HAROLD ROSENBERG was named plant manager, and ED HOLMES, promoted to planning manager. HERB RODAMAN was named assistant general manager, responsible for purchasing, accounting, and industrial relations.

GOULD & EBERHARDT, INC., Irvington, N. J., has arranged a license agreement with the Asquith Machine Tool Corporation, Ltd., Halifax, England, to manufacture and sell, in the United States, the Drummond Brothers, Ltd., "Maxicut" 2A and A gear-shaping machines. Gould & Eberhardt also have granted Drummond Brothers, Ltd., a license to build certain sizes of their gear-hobbing machines in England.

EDWARD J. BYERS has been appointed manager of the general order department at the New York plant of Joseph T. Ryerson & Son, Inc. The plant is located at 203 Westside Ave., Jersey City, N. J.

Ohio

LESTER M. COLE, general sales manager of the Warner & Swasey Co., Cleveland, Ohio, has been elected vice-president in charge of sales. Starting as a tool designer in the company's home office, he became successively sales and service

Lester M. Cole, vice-president, sales, Warner & Swasey Co.

representative in Dallas, Texas; manager of the company's district office in Houston; southern district manager; and general sales manager. In his new position, Mr. Cole will direct all sales activities of Warner & Swasey's Machine Tool Division, as well as those of the company's textile machinery and earthmoving equipment divisions.

J. HARRY ADAMS was named northern Ohio district sales manager of the S-P Mfg. Corporation, Solon, Ohio. Mr. Adams will be in charge of sales of the S-P line in the territory from Toledo east to Erie (Pa.) and south to include Mansfield, Ohio.

NATIONAL ACME CO., Cleveland, Ohio, has announced three executive promotions: Elected a vice-president was JOHN L. MOLNER, chief engineer. Molner has been with National Acme for forty-two years. Also advanced were ROBERT W. GILLESPIE, former assistant treasurer, to secretary, and E. L. BARNARD, assistant secretary and credit manager, to assistant treasurer.

SIFCO METACHEMICAL, INC., a newly formed subsidiary of the Steel Improvement & Forge Co., Cleveland, Ohio, has acquired the business and assets of the parent company's electrochemical division and has purchased the licensing rights in Canada and the United States for a specialized plating technique, the Dalic Process, previously owned by Dalic Metachemical Ltd., Toronto, Canada.

BOYD P. DOTY, JR., has been appointed to the post of general sales manager for the American Steel & Wire Division, United States Steel Corporation, Cleveland, Ohio. In his new capacity, he will act as sales manager for the entire division with offices in the Rockefeller Bldg., Cleveland, Ohio, headquarters.

CECIL S. ALLEN has been appointed director of engineering for the Electric Auto-Lite Co.'s Electrical Products Group, Toledo, Ohio. Mr. Allen will direct the group's expanded engineering program currently underway in its Toledo and Syracuse facilities.

JACK L. KENNEDY has been appointed to the position of chief sales engineer for the Press Division of the E. W. Bliss Co., Canton, Ohio. Mr. Kennedy joined Bliss in 1948 and has worked in both the Hastings, Mich., and Toledo, Ohio, plants of the company. He has spent the last eight years in the Canton, Ohio, general office as sales engineer.

John L. Molner, newly elected as a vice-president, National Acme Co.

Jack L. Kennedy, chief sales engineer, Press Division, E. W. Bliss Co.

From the Report — A Typical Cylindrical Job

Page 6 On a crush-truing job in Indiana, a 20 x 2 x 12" wheel was used . . . for grinding . . . a machine spindle. The material was about Rockwell C48 . . . when a wheel of 32A120-N9VG (32 ALUNDUM — G bond) was put on the job, the operator reported he could get 4 times as many pieces per dressing before the wheel face began to lose its shape, and yet there was no trace of burn.

Hot off the press!

From Norton to you

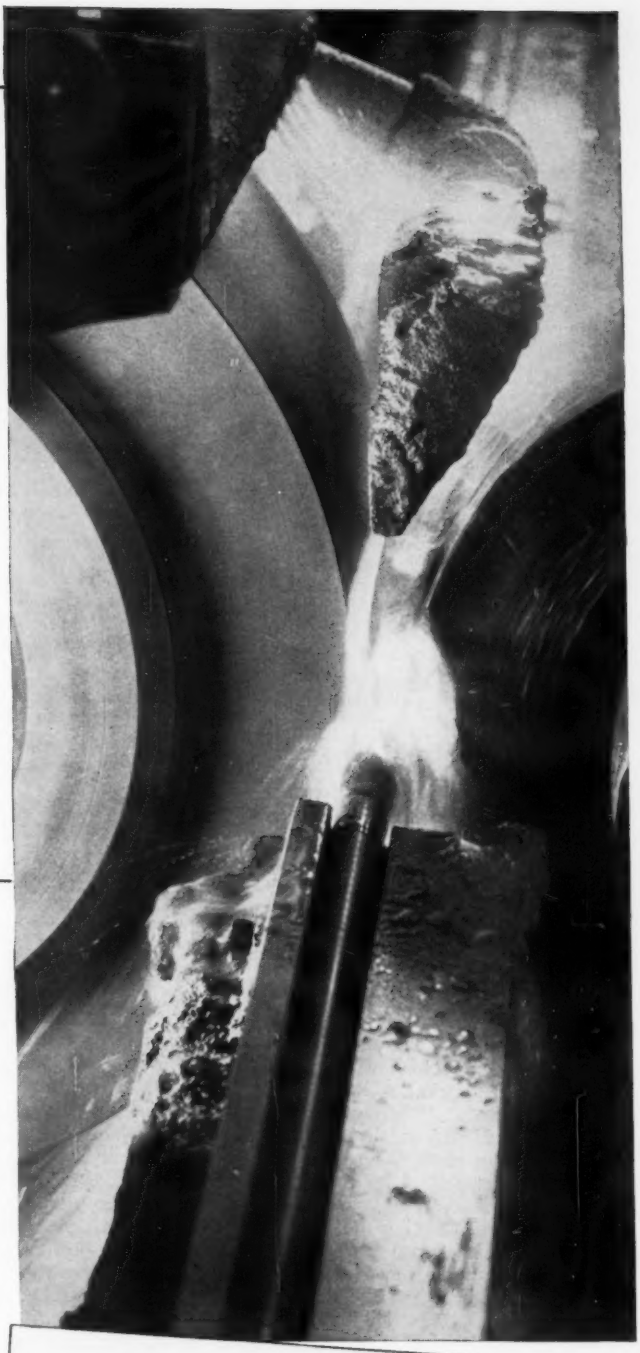
Join the nation-wide progress now being made in every type of O.D. grinding! The new Norton publication, *A Report on O.D. Grinding*, tells you how.

Based on extensive service by helpful Norton Men, this Report brings you many valuable new solutions to O.D. problems . . . describes "tricks of the trade" that get the most out of cylindrical and centerless machines . . . provides on-the-job performance of different grinding wheels in different applications . . . and analyzes the following highly efficient abrasives and bonds.

Abrasives. 44 ALUNDUM* (aluminum oxide) abrasive, an ideal cost-cutter for many O.D. jobs. 32 ALUNDUM abrasive, top-quality for grinding various materials, including harder steels. The other time-tested Norton ALUNDUM abrasives are also included. And 37 and 39 CRYSTOLON* (silicon carbide) abrasives are best-suited for grinding cast-iron, non-ferrous metals, carbides and other materials.

Bonds. G bond, biggest advancement in vitrified bonds, gives best results in most O.D. jobs, particularly crush-truing. Vitrified BE bond is

An Up-To-The-Minute Report *filled with* Inside Facts on Outside Grinding



another widely-used favorite. Where CRYSTOLON abrasive is required, K bond is outstanding. B11 resinoid bond excels in uniformity with both ALUNDUM and CRYSTOLON wheels. For centerless feed wheels, R51 rubber bond assures complete regulating control without slippage.

Your Norton Man will be glad to work with you in determining just what improvements in grinding methods and wheel selection will assure you the lowest cost-per-piece produced. More news about how this expert can bring the value-adding, profit-boosting "Touch of Gold" to your production is stated in the Report. Your copy of this Report is available from your local Norton Representative . . . and is as near as your phone. Call for it today. NORTON COMPANY, General Offices, Worcester 6, Mass. Plants and distributors around the world

From the Report — A Typical Centerless Job

Page 6-7. On a centerless operation involving heavy stock removal from 2" diameter bars 4' long, 44A54-MVBE (44 ALUNDUM — BE bond) has been reported to be the best wheel specification they have ever used. It cuts faster, cooler and requires less truing than any other vitrified wheel . . . is priced much lower than resinoid or rubber bonded wheels.

NORTON ABRASIVES

*Trade-Marks Reg. U. S. Pat. Off. and Foreign Countries

W-1900

Making better products . . . to make your products better

NORTON PRODUCTS Abrasives • Grinding Wheels • Grinding Machines • Refractories • Electrochemicals — BEHR-MANNING DIVISION Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes

For more data, circle this page number on inquiry card

SIMONDS-WORDEN-WHITE CO., Dayton, Ohio, announces appointments of DONALD R. STEWART as district sales manager and KENNETH E. MELVIN as sales representative. Mr. Stewart will be responsible for grinding-wheel sales in Michigan and northern Ohio. Mr. Melvin will work under his direction.

HERCULES MOTORS CORPORATION, Canton, Ohio, announces that ADOLPH A. KARRASCH has been appointed director of manufacturing of the corporation.

B. R. "BOB" TEREE has been appointed vice-president in charge of engineering by the Republic Mfg. Co., Cleveland, Ohio.

(Left) William P. Flohr, chief engineer, and (right) Ralph E. Price, executive vice-president and assistant general manager, Landis Tool Co.

Pennsylvania

CARPENTER STEEL CO., Reading, Pa., has appointed AVARD W. TAYLOR as general sales manager, Mill Product Division. Mr. Taylor will have his headquarters at the main mill in Reading. The company has created new managerial positions in the sales field in order to increase service to customers in the Pacific, Mid-Western, and East Central areas. DAVID J. O'NEIL has been appointed Pacific regional manager; WILLIAM C. KUNKELMAN has been appointed Mid-Western regional manager; and HAROLD R. POTTER has been named East Central regional manager. Both Mr. O'Neil and Mr. Potter will work out of Carpenter's Los Angeles and Cleveland warehouses, respectively, while Mr. Kunkelman will work from the firm's Cincinnati office. Three district supervisory changes in the company's eastern sales territories have been made. ROBERT P. UHL, now district manager of New York, has had his responsibilities expanded to include the sales area served by the company's Bridgeport, Conn., warehouse. ROBERT A. KOKAT has been promoted to district manager, Philadelphia, responsible for sales in the area served by the Philadelphia warehouse. ALDRIDGE E. HUNT, JR., has been appointed district manager, Hartford, Conn., and Providence, R. I.

LANDIS TOOL CO., Waynesboro, Pa., announces the following personnel changes. RALPH E. PRICE has been elected executive vice-president and assistant general manager. He has been general manager of the company's wholly owned subsidiary, Gardner Machine Co., Beloit, Wis., and most recently, vice-president of Landis. EUGENE R. FOGT has been elected assistant treasurer. DANIEL H. RUTH has been named sales promotion and advertising manager. WILLIAM P. FLOHR was appointed chief engineer.

DONALD LADE has been appointed southeastern district sales manager of Baldwin-Lima-Hamilton Corporation, Philadelphia, Pa.

New Books

MARKS' MECHANICAL ENGINEERS' HANDBOOK. Sixth Edition. Prepared by a Staff of Specialists. Theodore Baumeister, Editor-in-Chief. 2320 pages; illustrated; 6 by 9 inches. Published by McGraw-Hill Book Co., 327 W. 41st St., New York 36, N. Y. Price, $23.50.

This Sixth Edition touches on every branch of mechanical engineering. Theory, standards, and practice in areas ranging from railway engineering to jet propulsion, and from mechanical refrigeration to hoisting and conveying, are covered by over 100 experts in the various fields.

The same format and arrangement are retained and the same type of material offered as past editions. In addition, this volume reflects advances in high-speed aerodynamics, including material on transonic and supersonic flow, shock waves and Mach cones, and other subjects. Nuclear power is covered in this edition and reflects modern thinking on effects of irradiation, health physics, reactor design, economies, and future development of this source of power. Among the many other topics either new or completely recast are automatic computing machines and their uses, mechanics of materials, etc.

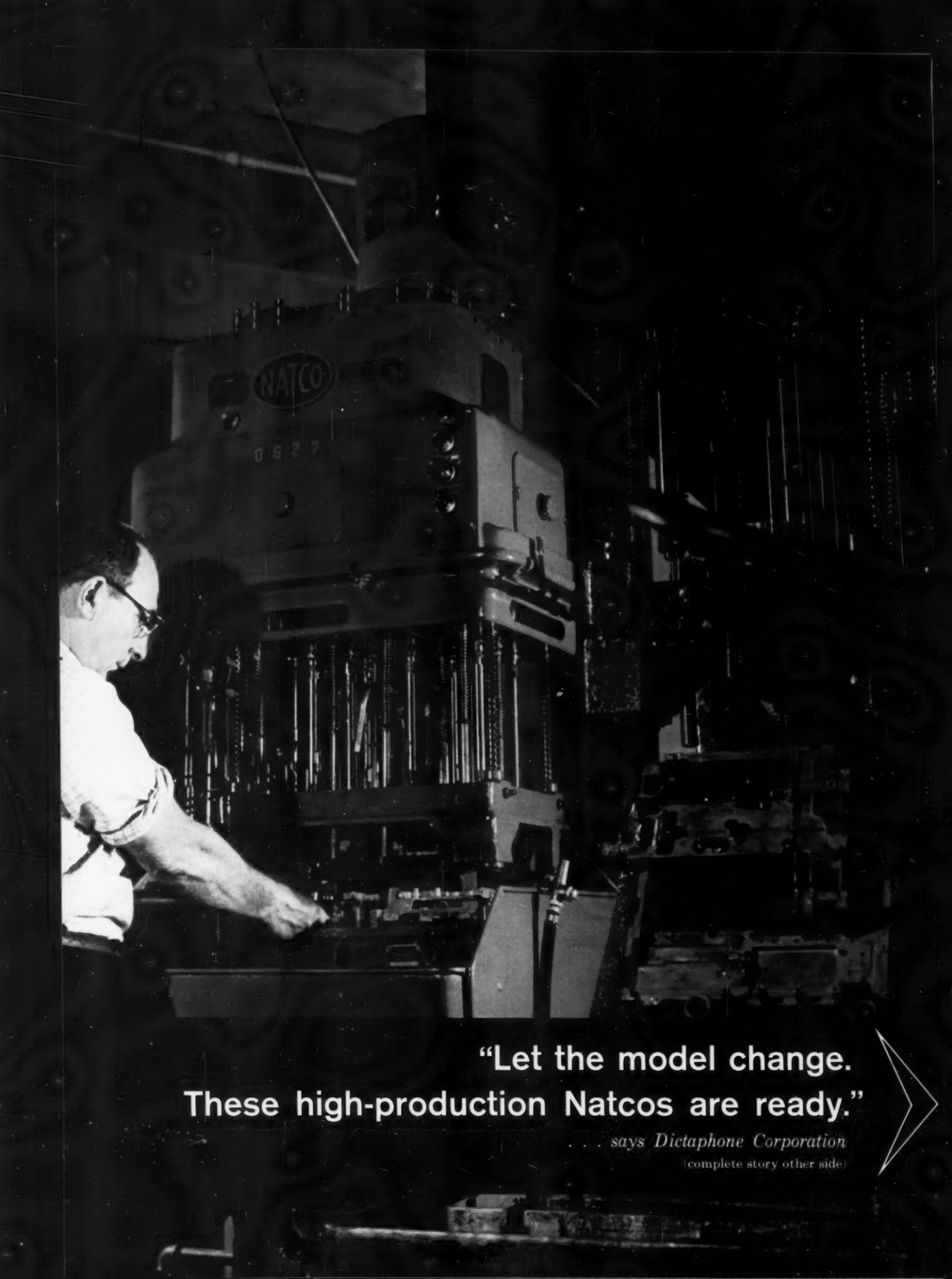
AUTOMATIC PROCESS CONTROL. By Donald P. Eckman. 6 by 9 inches; 368 pages; illustrated. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. Price, $9.

Written for all engineers who are concerned with instrumentation, this book treats the important principles of automatic control, emphasizing block diagrams and frequency techniques in process control. It begins with process analysis and carries on into the generalized behavior of closed-loop systems. System problems are given a great deal of study. The techniques of analysis are used to the fullest extent, and enough detail is carefully presented so that some of the more difficult problems in automatic process control may be inspected rather closely. The author incorporates numerous problems with answers and nine detailed experiments, including the analog computer.

Coming Events

MAY 12-14—ASME Production Engineering Conference to be held in Detroit, Mich., at the Statler-Hilton Hotel. For further information contact Henry J. Langlois, Chairman, Publicity Committee, in care of American-Standard Industrial Division, 8111 Tireman Ave., Detroit 32, Mich.

MAY 25-28—Design Engineering Show at Convention Hall, Philadelphia, Pa., in conjunction with Fourth Annual Design Engineering Conference sponsored by the ASME. Further information may be had from Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N.Y.



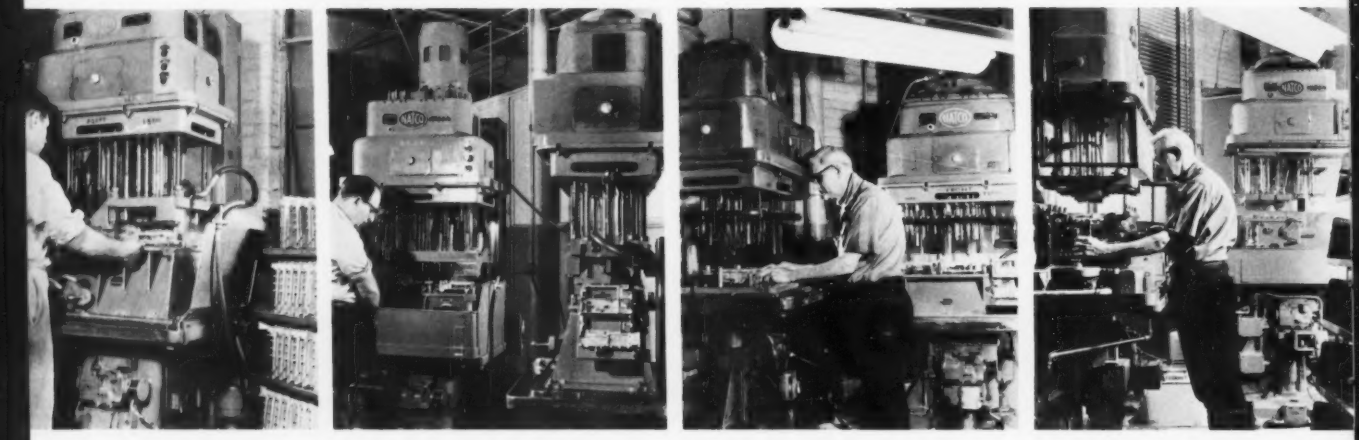
"Let the model change. These high-production Natcos are ready."

. . . says *Dictaphone Corporation*

(complete story other side)

Five parts for the cost of one!

Fast changeover too!



These 7 standard Natcos do it for Dictaphone!

Costs toppled 81%, savings exceeded $1.00 per part when Dictaphone Corporation, Bridgeport, Conn., switched from gang drill production to this line of seven high-production H-6 Natcos. *Standards*, not specials. They quickly convert when models change; and replacement parts for old models can be run on the same line with minimum time for changeover.

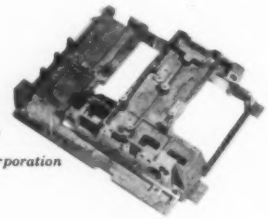
Dictaphone's part is a magnesium main frame for its Time-Master dictating machine. It calls for drilling 97 holes and performing 150 secondary operations—reaming, tapping, counterboring and countersinking on most of them. The seven multi-spindle Natcos handle all but 16 of these operations.

Besides increasing production 81 per cent, the seven Natcos eliminate skipped and creeping holes, and maintain close tolerances. Natco tooling locates the magnesium parts without warping stresses.

On the Natco H-6, the slip plate is the key to flexibility. For example, Dictaphone transferred four Natcos from other assignments, simply by fitting them with new slip spindle plates and, of course, new fixtures. Three new Natcos filled out the line.

Natco H-6 and other multi-spindle drilling machines are available in models from 1 hp with 10 spindles to 50 hp with up to 72 spindles. Write today for complete details or see your Natco representative.

Under the cover of
the Time-Master *,
. . . profits in 97 holes.



*Registered trademark of Dictaphone Corporation

NATCO

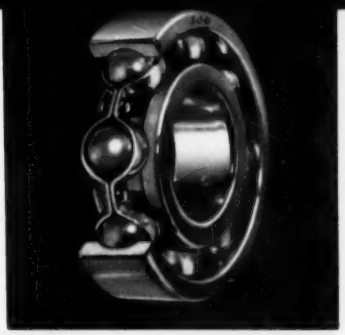
NATIONAL AUTOMATIC TOOL COMPANY, INC., RICHMOND, IND.

so quiet...

The SKIPJACK was built for the Navy by General Dynamics Corporation, Electric Boat Division.

Newest and fastest of the Navy's fabulous nuclear submarines is the SKIPJACK, designed to carry out underwater missions in utmost silence. That is why the hushed quietness of Hoover quality ball bearings makes them the first choice for critical applications. Precision-made with super-smooth *Hoover Honed* raceways and perfectly matched sets of *Micro-Velvet* balls, Hoover ball bearings contribute to the quiet, enduring performance of a wide range of products.

Hoover Honed and *Micro-Velvet* are Hoover Trademarks.



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Hoover Ball and Bearing Company
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use Airco's new Dip Transfer† *CO_2 Process***

for **ALL-POSITION WELDING OF STEEL IN ALL THICKNESSES**

low costs · easy fit up · high speed · very low spatter · no warpage

In welding mild sheet steel manually, there's only *one way to reduce costs and produce high quality welds* at the same time. Airco Dip Transfer CO_2 Process Welding. Let's be specific: –

- The complete Airco Dip Transfer CO_2 package welds in all positions . . . manually!
- Welds are hydrogen-free.
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- Creates little or no spatter.
- Handles typical steel joint fit ups.
- No flux needed.
- Penetrates deeply – critical for high quality.
- Welds much faster than flux-based processes.
- Uses money-saving Pureco CO_2 as shielding gas.
- The basic equipment welds all weldable metals.

The Airco Dip Transfer CO_2 Process gives you consistently *high quality* welds at *lower costs* than any other process. For complete information, phone or write your nearest Air Reduction Representative. Ask for the new 24-page "AIRCOMATIC CO_2 WELDING" Catalog.

Pureco CO_2 is supplied by the Pure Carbonic Company, a division of Air Reduction Company, Incorporated.
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Precision gear grinding economy

—Plus this 4-way versatility

Choose from any of these cycles with selective feed increments:

1 Rough grinding
2 Rough grind; finish grind
3 Rough grind; semi-finish grind; finish grind
4 Manual grind

GEAR DATA

No. Teeth	96
Pitch Diameter	26.7"
Diametral Pitch	3.6
Pressure Angle	25°
Face Width	4.5"

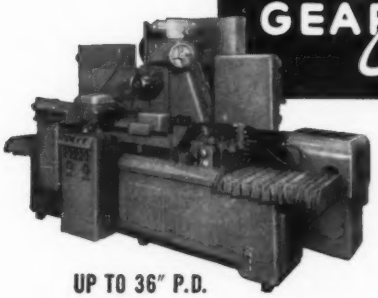
FLOOR TO FLOOR PRODUCTION TIME

Single Gear/Arbor	55 min/gear
Two Gears/Arbor	33 min/gear

GEAR ACCURACY

Involute Profile	Within .0002"
Tooth to Tooth Spacing	.0003" max.
Runout of Pitch Diameter	.0006" total
Lead Error	Less than .0001"/"

GEAR GRIND *Detroit*



UP TO 36" P.D.

For all the facts—write today!

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Manufacturers of:

RZEPPA ("Sheppa") Constant Velocity Universal Joints

58-MT5A

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To find headings easily, look for capital letters at top of each page to denote location.

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Gardner Machine Co., Beloit, Wis.
Macklin Co., Jackson, Mich.
Norton Co., 1 New Bond St., Worcester, Mass.
Simonds Abrasive Co., Tacony & Fraley Sts., Philadelphia 35, Penna.

ABRASIVES, Polishing, Tumbling, Etc.
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It gives full details.

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Narda Hydraulics Corp., Mineola, N. Y.

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AIR GUNS
Chicago Pneumatic Tool Co., New York, 17, N. Y.
Schrader's Sons, A., 470 Vanderbilt Ave., Brooklyn 38, N. Y.

AIR TOOLS—See Grinders, Portable, Pneumatic—Drills, Portable, Pneumatic, Etc.

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Bethlehem Steel Co., Bethlehem, Pa.
Ryerson Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., Carnegie-Illinois Steel Corp. Div., 436 7th Ave. Pittsburgh, Pa.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

ALLOYS, Bearing
Bunting Brass & Bronze Co., 715 Spencer, Toledo 1, Ohio.
Carpenter Steel Co., 105 W. Bern St., Reading Penna.
Mueller Brass Co., Port Huron, Mich.

ALUMINUM and Aluminum Products
Revere Copper & Brass, Inc., 230 Park Ave., New York 17, N. Y.
Ryerson & Son, Jos. T., 16th & Rockwell Sts., Chicago 8, Ill.

ANGLE PLATES—See Set-up Equipment

ANNEALING FURNACES
Eisler Engrg. Co., 750 So. 13th St., Newark 3, N. J.

ARBOR PRESSES—See Presses Arbor

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Brown & Sharpe Mfg. Co., Providence, R. I.
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill. (end mills)
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
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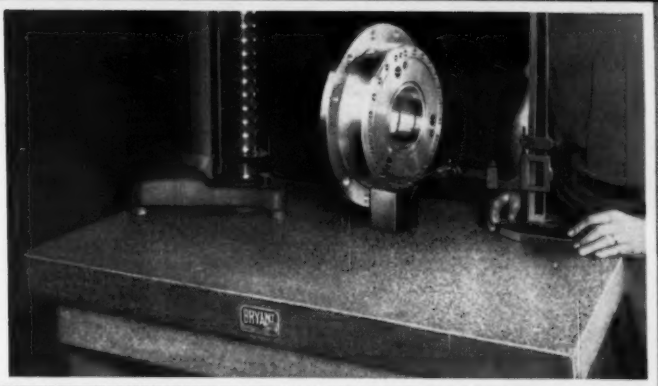

. . . when it's checked on a BRYANT PRECISION THREAD GAGE

The Bryant B-21 Bench Gage checks parts with internal and external threads in all tolerance classes to 5" diameter, checks parts with special grooves, snap ring or O-ring grooves, checks squareness of face (attachment illustrated) and concentricity of diameters—and does it 8 to 10 times faster! The B-21 is not threaded into the part, instead uses interchangeable, stationary and movable gaging segments which far outlast ring and plug gages. An accurate, visual check to full limits of pitch diameter eliminates the element of "feel" in inspection of precision parts. A full complement of standard and special accessories makes the B-21 Bench Gage indispensable to product quality control.

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Sheffield Corp., Box 893, Dayton 1, Ohio

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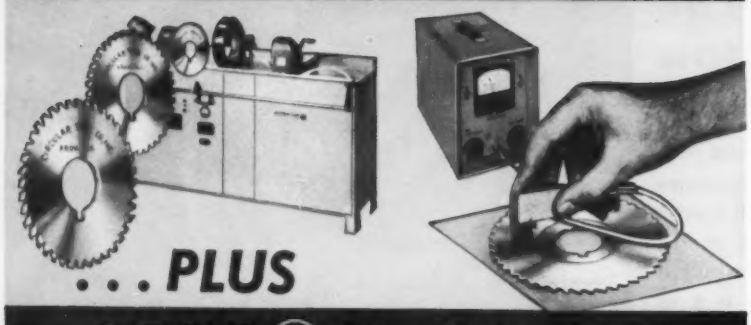

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Circle R Cutting tools better your production with longer runs, less down time, sustained tolerances, fewer stoppages for resharpening — yet cost no more. Consult our Factory Consultation Service at the plant — or call in your Circle R Specialist.

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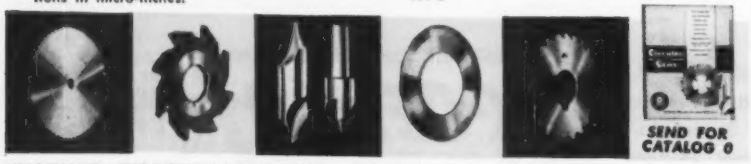

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Mueller Brass Co., Port Huron, Mich.
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Shenango Furnace Co., Dover, Ohio

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Carpenter Steel Co., 105 W. Bern St., Reading, Penna.
Ryerson, Joseph T. & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.

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Fafnir Bearing Co., New Britain, Conn.
Hoover Ball & Bearing Co., Ann Arbor, Mich.
Japan Bearing Export Co., Ltd., Tokyo, Japan
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Nice Ball Bearing Co., 30th & Hunting Park Ave., Philadelphia, Pa.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
S K F Industries, Inc., Philadelphia, Penna.

BEARINGS, Bronze and Special Alloy
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Bunting Brass & Bronze Co., 715 Spencer, Toledo, Ohio

BEARINGS, Oilless
Bunting Brass & Bronze Co., 715 Spencer, Toledo 1, Ohio
Ryerson, Joseph T. & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.

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Norma-Hoffmann Bearings Corp., Stamford, Conn.
Rollway Bearing Co., Inc., 541 Seymour St., Syracuse, N. Y.
S K F Industries, Inc. Philadelphia, Penna.
Timken Roller Bearing Co., Canton, Ohio

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Fafnir Bearing Co., New Britain, Conn.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Nice Ball Bearing Co., Nicetown, Philadelphia, Pa.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
Rollway Bearing Co., Inc., Syracuse, N. Y.
S K F Industries, Inc., Philadelphia, Penna.
Timken Roller Bearing Co., Canton, Ohio.

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Houghton, E. F. & Co., 303 W. Lehigh Ave., Philadelphia 33, Penna.

BELT SANDERS—See Grinding Machines, Abrasive Belt

BENCH CENTERS
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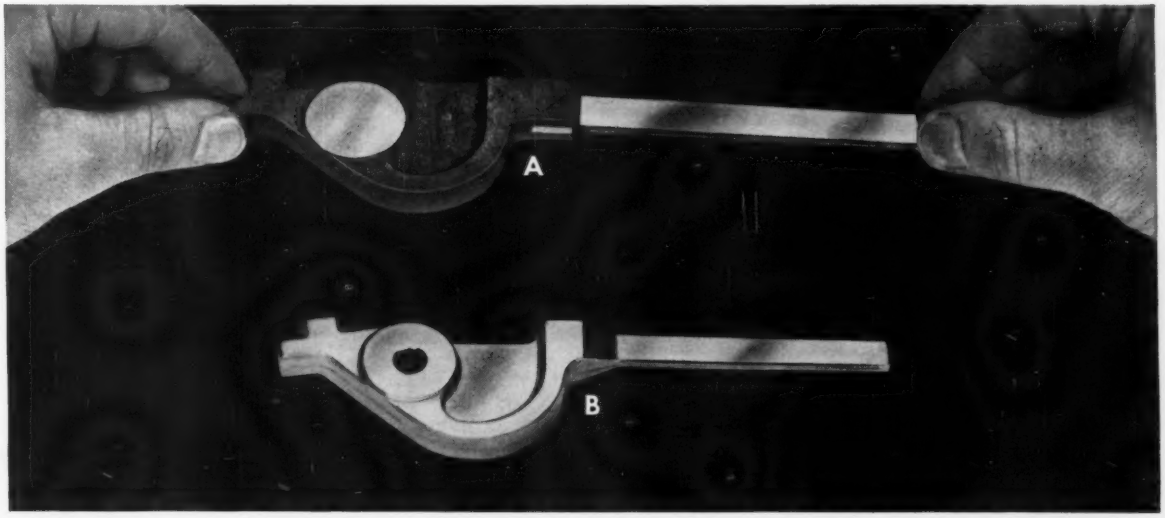
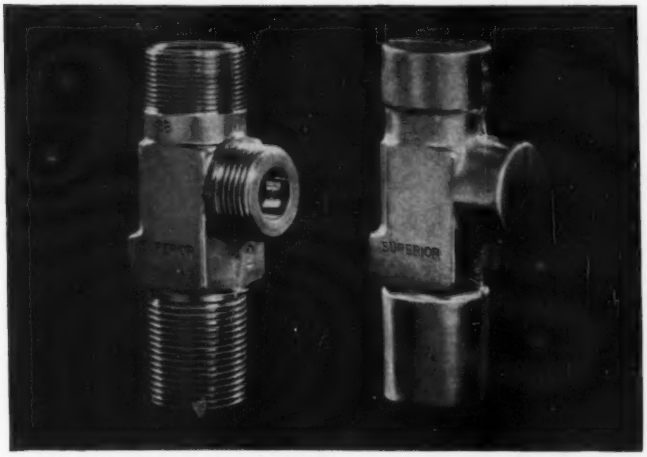
Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.

QUALITY CONTROL PLUS SAVINGS Value analysis suggested the use of a die-pressed forging. The result: an 85% cost reduction and a stronger, tougher part.



SWITCH BLADE in overspeed limiting device on large General Electric motor-generators was originally an assembly **A**—an arm brazed to a brass casting which was machined, slotted, and drilled. After review in the company's Value Analysis program, assembly was replaced by Anaconda die-pressed brass forging **B.** The superior strength of twice-wrought metal made possible a one-piece part. The excellent finish and consistent dimensional accuracy of the die-pressed forgings eliminated all machining but the drilling operation. The over-all cost is 15% of the original part.



VALVES FOR CHLORINE AND FLUORINE shipping containers must have unusual corrosion resistance and high strength. Superior Valve & Fittings Co., Pittsburgh, specialists in handling halogens, looked for a forging alloy that would be suitable. American Brass Company metallurgists suggested die-pressed forgings of a slightly modified Everdur®-1014, an aluminum-silicon bronze, for this chlorine-fluorine service, and this customer is finding wide use for it in other severe service, too. The twice-wrought metal of Anaconda die-pressed forgings has dense structure to prevent leaks—strength and toughness to take rough handling. Yet it can be machined in automatic-chucking machines resulting in good cost control.

THE vital job of controlling quality *and* costs may be easier than you think. Anaconda technical specialists will gladly help you find the right alloy and mill form to do both. See your American Brass Company representative or write: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont. 6040

DIE-PRESSED FORGINGS **SPECIAL-SHAPE TUBES**
EXTRUSIONS **FABRICATED METAL PARTS**

products of

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made by The American Brass Company

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DeVlieg Microbore Div., 2720 W. Fourteen Mile Road, Royal Oak, Mich.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Mummert-Dixon Co., Hanover, Pa.
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Universal Engineering Co., Frankenmuth 2, Mich.
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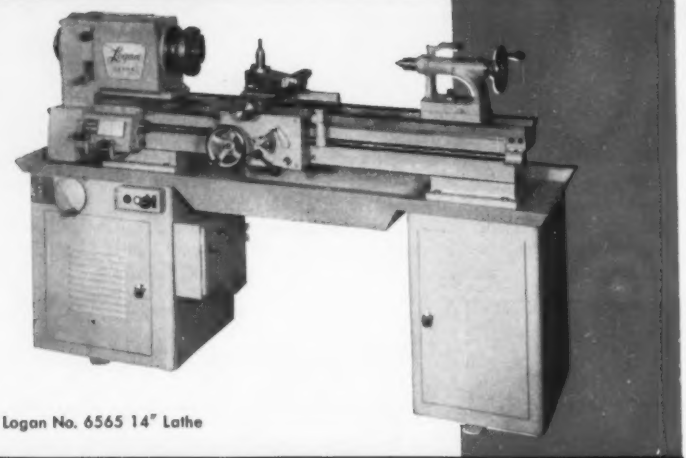
its specifications add up to high production capacity

Logan 14" Lathe



Logan No. 6565 14" Lathe

Logan designs greater reliability and accuracy, and longer life into its lathes by a generous combination of high-capacity features. For instance—

- An oversize spindle with 1⅝" bore turns on four super-precision ball bearings with built-in preload
- A variable-speed drive lets you change speed while work is turning—without shifting belts
- A warp-free lathe bed with high, strong walls braced by oversize ribs to withstand heaviest stresses; two V-ways and two flat ways are flame-hardened and precision-ground.

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- Spindle speeds to 2000 rpm
- 1½" Levermatic collet chuck capacity
- 14¾" swing over bed
- 9" swing over saddle cross slide
- 40" between centers

LOGAN ENGINEERING CO. Dept. K-559 4901 Lawrence Avenue, Chicago 30, Illinois

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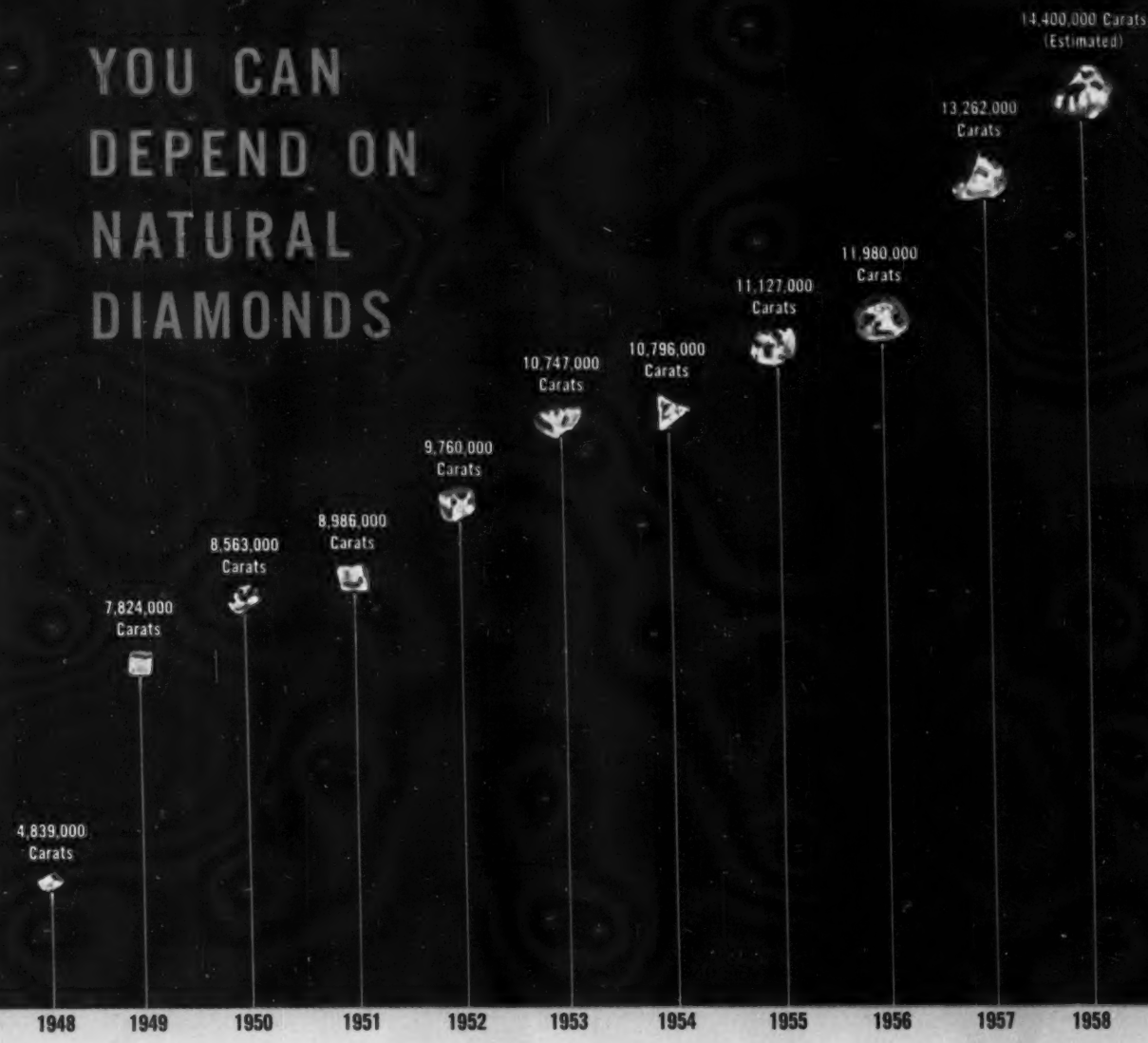

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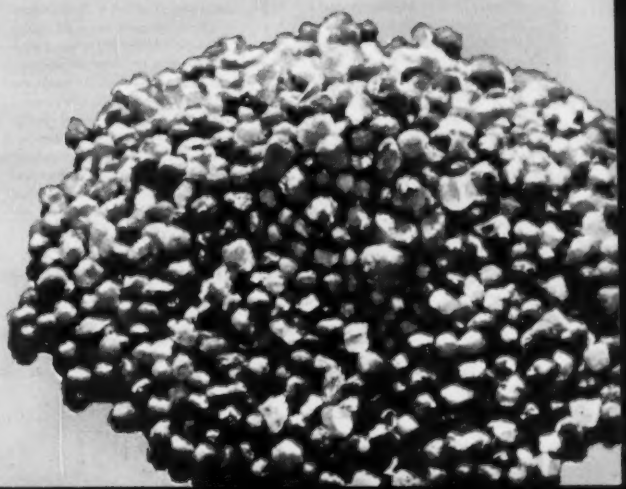
Since 1948 production of crushing boart has risen 197 per cent. This means that there are ample supplies of natural diamond mesh for all the needs of American industry.



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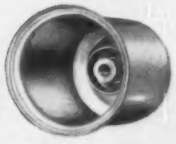
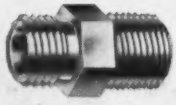


COLD-PREST® IMPACT EXTRUSIONS

Mueller Brass Co. has complete machinery for producing Cold-Prest impact extrusions of aluminum, copper, brass, bronze and steel. Extrusions up to 28" in length are possible, depending on wall thickness and other design details. Parts can be designed having ribs, flutes, splines or bosses . . . with multiple wall diameters and with uniform or tapered wall sections.



SCREW MACHINE PRODUCTS

Mueller Brass Co. has one of the world's largest automatic screw machine departments fabricating both ferrous and non-ferrous custom parts. We can produce an infinite variety of shapes and sizes from ⅛" to 3¼" in wide range of free cutting and specialized alloys. Complete facilities for all secondary and finishing operations, as well.

POWDER METAL PARTS

Mueller Brass Co. can supply precision Sinteel® powder metal parts in wide range of sizes and metals at high production rate. Parts available from iron, brass and copper alloys. Parts may be ordered with such characteristics as self-lubrication, controlled porosity and good electrical and magnetic properties.

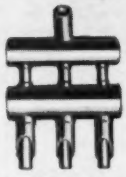
MADE IN U.S.A. TO THE STANDARDS OF AMERICAN INDUSTRY

MUELLER BRASS CO.

...and our methods analysis service helps you determine which is the best ...and most economical method

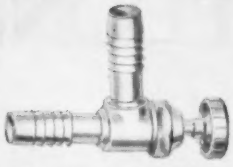
SAND CASTINGS

We specialize in the production of pressure-tight red brass castings. We utilize both metal match plate and wood patterns. Facilities include tool room and pattern shop, electric melting furnaces, high capacity core room and both bench and floor molding equipment to handle wide range of sizes.



FORMED COPPER TUBE

Mueller Brass Co. has modern facilities for forming seamless copper tube into a multitude of shapes. Forming methods used include bending, spinning, expanding or swedging, upsetting, flaring, flattening, beading and grooving, drilling and piercing, machining and joining. Formed copper tube coils are also available as single, double, spiral and serpentine shapes.



PLASTIC INJECTION MOLDING

Injection molding of plastic parts is still another process offered by the Mueller Brass Co. Parts are molded from such plastics as—nylon, polyethylenes, polyvinyl chloride, styrenes, linear acetal, chlorinated polyether, polycarbonates or polypropylene, dependent on part application.

MAN FROM MUELLER BRASS CO.

Since only Mueller Brass Co. can produce your part by all the methods, only the Man From Mueller Brass Co. can give sound advice on the one best method of production. Over 40 years of research, engineering, manufacturing and marketing experience stands behind him. When you are specifying and purchasing fabricated metal parts, call in the MAN FROM MUELLER BRASS CO.

271

PORT HURON 27, MICHIGAN

Gray Co., G. A., 3611 Woodburn Ave., Cincinnati 7, Ohio
Hamilton Div., Baldwin-Lima-Hamilton Corp., Hamilton, Ohio
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Jones & Lamson Machine Co., Springfield, Vt.
Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Moline Tool Co., Moline, Ill.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Olivetti Corp. of America, 42-33 Northern Blvd., Long Island City 1, N. Y.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Olofsson Corp., Lansing, Mich.
Orban Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sheffield Corp., Box 893 Dayton 1, Ohio
Snyder Corp., 3400 E. Lafayette Ave., Detroit 7, Mich.
Wales-Strippit, Inc., Akron, N. Y.

BORING MILLS, Horizontal
American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Bullard Co., Bridgeport 6, Conn.
Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio.
Consolidated Mch. Tool Div., 565 Blossom Rd., Rochester 10, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
DeVlieg Machine Co., Fair St., Royal Oak, Mich.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Gray, G. A., Co., 3611 Woodburn Ave., Cincinnati 7, Ohio.
Lucas Mch. Tool Div., New Britain Mch. Co. 12302 Kirby Ave., Cleveland 8, Ohio.
New Britain Mch. Co., New Britain, Conn.
Snyder Corp., 3400 E. Lafayette Ave., Detroit 7, Mich.

BORING MILLS, Vertical
American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Berthiez, Charles, 5 Rue Montalivet, Paris France
Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.
Consolidated Mch. Tool Div., 565 Blossom Rd., Rochester 10, N. Y.
Cosa Corp, 405 Lexington Ave., New York 17, N. Y.
Hamilton Div., Baldwin-Lima-Hamilton Corp., Hamilton, Ohio
Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.
King Machine Tool Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio.
New Britain Mch. Co., New Britain, Conn.
Snyder Corp., 3400 E. Lafayette Ave., Detroit 7, Mich.

BORING TOOLS
American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago 46, Ill.
Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
DeVlieg Microbore Div., 2720 W. Fourteen Mile Road, Royal Oak, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Vascoloy-Ramet Corp., Waukegan, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

BRAKES, Press and Bending
Cincinnati Shaper Co., P. O. Box 111, Cincinnati 11, Ohio.
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Ferracute Machine Co., Bridgeport, N. J.
Lodge & Shipley Co., Hamilton 1, Ohio.
Niagara Mch. & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.

BRASS
American Brass Co., 25 Broadway, New York N. Y.
Mueller Brass Co., Port Huron 35, Mich.
Revere Copper & Brass, Inc., 230 Park Ave., New York, N. Y.

BROACHES
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.

BROACHING MACHINES, Internal
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.

BROACHING MACHINES, Surface
Cincinnati Milling & Grinding Mchs., Inc., Cincinnati, Ohio.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.

BRONZE
American Brass Co., Waterbury 20, Conn.
Mueller Brass Co., Port Huron 35, Mich.

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Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland, Ohio.

PUSH BUTTON *Speed Selection*

from to in seconds

or to *any* intermediate speed, *instantly*

Just push a button and watch the large tachometer dial on the headstock!

It's that easy!

The work is done by a motor driven speed changer. It accelerates or slows the lathe to any desired speed in seconds. With a 10:1 ratio, this new variable drive makes it easy to select from a wide range of speeds—200 to 2000 rpm in direct drive and 40 to 300 rpm in back gear.

Maximum stability and smooth power transmission are assured because the drive unit is oversized. All pulleys and shafts are fully supported (eight bearings). Double V-belts throughout the drive eliminate slippage and deliver full power to the spindle. Because of this rigidity and extra pulling power, this lathe will take heavy cuts at all speeds and precision finish cuts at high speeds.

It is a precision lathe, moderate in price, with the versatility for toolroom, production or second operation jobs.

SHELDON *Variable Speed* PRECISION LATHES

Illustrated
WM56P
13" Swing- 34" Centers
Base Price F.O.B. Factory
$2146.00
Less Chip Pan and Electricals
Also available with 11" Swing

Write for
"Variable Speed" Circular and General Catalog showing . . .
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10", 11", 13" and 15" SHELDON Precision Lathes (Bench, Pedestal and Cabinet types)
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13" and 15" SEBASTIAN Geared Head Lathes
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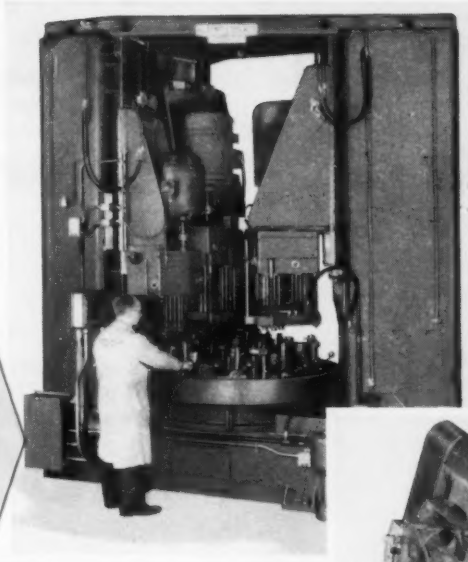
MACHINE TOOLS FOR EVERY INDUSTRY

Since 1898 . . . Kearney & Trecker Customer Engineering Service — supported by an outstanding staff of engineers experienced in production milling machine design and application — combined with the finest and latest machine tools in an ultra modern plant is always ready to solve your production problems.

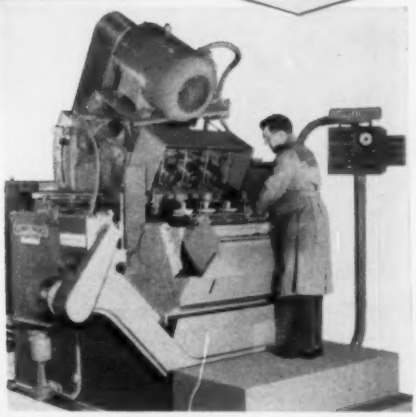


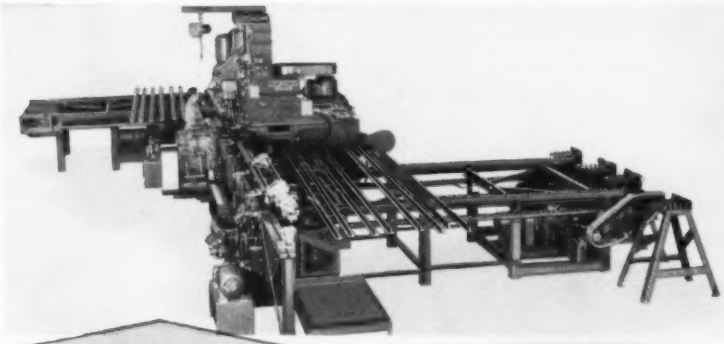
Oil Industry

automatic 4-spindle milling machine mills 4 rock bit cones *simultaneously*... in a trunnion-type fixture having 4 work-piece spindles. PRODUCTION — a constant flow of this expendable type tool to meet the steady demand.

Automotive Industry

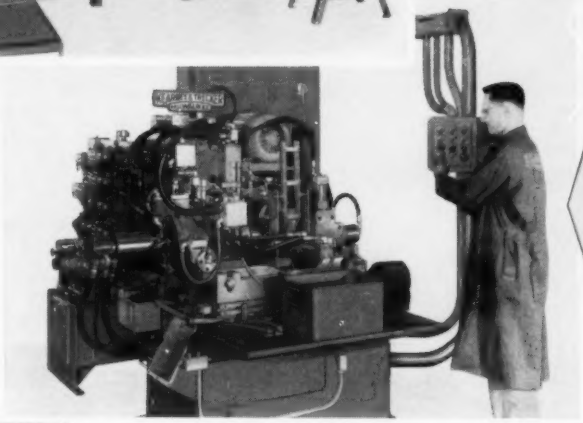
this 88 spindle, 3 vertical head machine performs drilling, chamfering, counterboring, trepanning, spot-facing, reaming and tapping operation on a differention case and cover. PRODUCTION — 67 cases, 67 covers per hour.





Elevator Industry

12 spindle automatic transfer machine mills mating tongue and groove on ends of elevator guide rail-drills mounting holes in rail flanges—for continuous rail mounting. PRODUCTION—28 completely machined rails per hour — 180% increase over old method.



Tool Industry

Flutes and shank squares are milled on tap blanks by this automatic machine. Tap blanks are hopper loaded and automatically unloaded. RESULT—greatly increased hourly production.

KEARNEY & TRECKER MILWAUKEE ®

Write for bulletin SMD-57 on your company letterhead.

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Special Machinery Division

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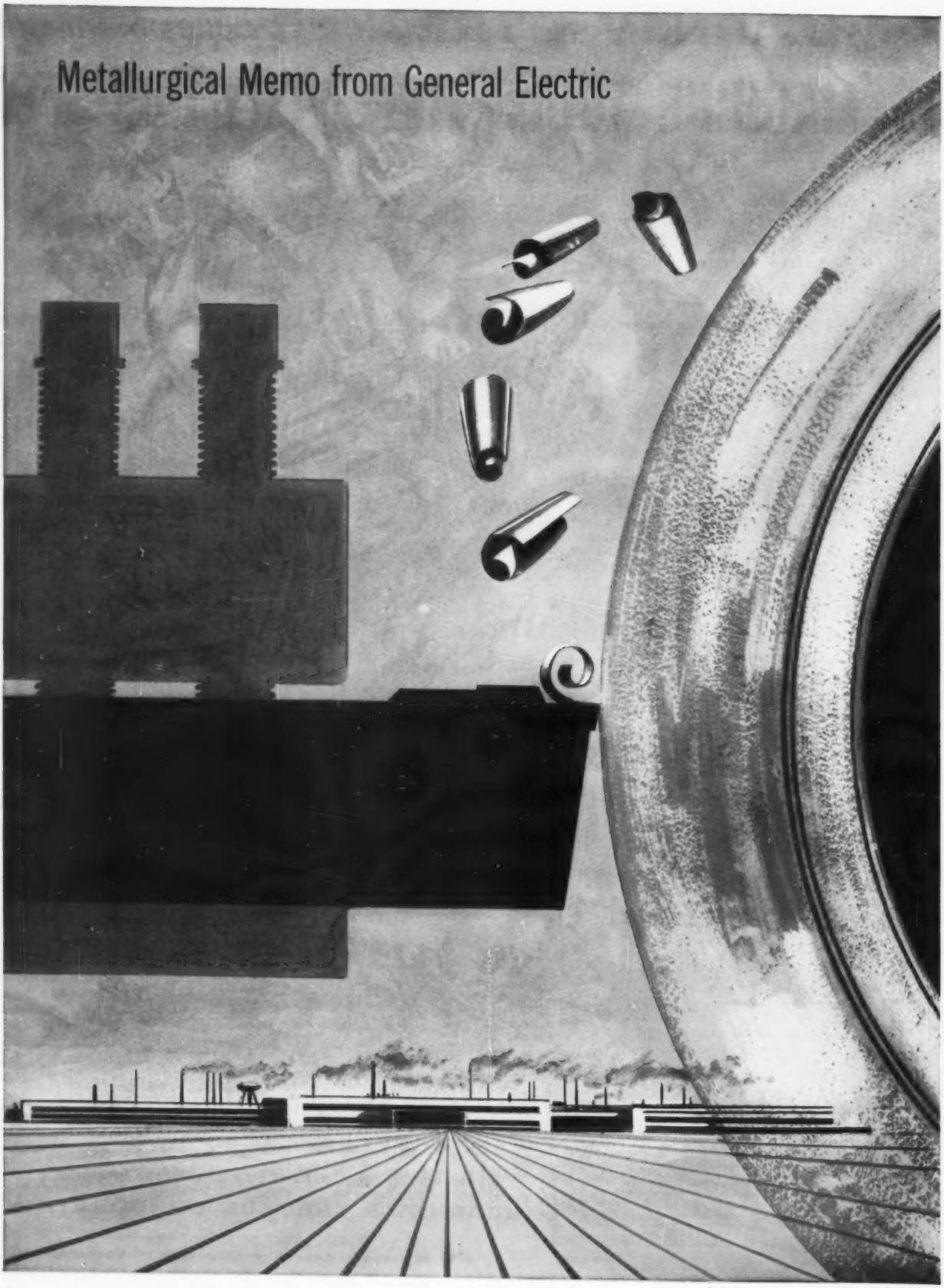
Metallurgical Memo from General Electric

Why 242 different toolholders?

Metallurgical Products Department reports
on an expanded new line of Lift-O-Matic toolholders
. . . 242 sizes to speed changeovers on every job

Nobody needs to tell you what carbides have done for metalcutting . . . or how Carboloy® disposable inserts have led the way. *But making inserts is only half the job;* the other half is to provide you with toolholders that let you get full value from these miracle metals.

Carboloy Lift-O-Matic toolholders do this job. There are now three types—positive rake, negative rake, and tracer. All provide access to the clamp setscrew from either top or bottom—all provide for fastest possible indexing or changeover—all cut your inventory needs by providing interchangeability of parts. In addition, Carboloy *heavy duty* toolholders are made for cutting conditions where a maximum strength holder is demanded.

This expanded Lift-O-Matic toolholder line is stocked by your *local* Authorized Carboloy Distributor—3 types, 9 styles, 242 sizes—*plus* the widest range of styles, sizes, and grades of *inserts* in the industry. Call him (see the Yellow Pages under "Carbides"); or write: *Metallurgical Products Department of General Electric Company, 11147 East 8 Mile Blvd., Detroit 32, Michigan.*

New! Self-raising chipbreaker clamp. A twist of the wrist releases insert for indexing . . . automatically lifts and lowers chipbreaker. No more prying chipbreaker free. No more fumbling with loose chipbreaker. You choose from three chipbreaker widths for more accurate chip control.

CARBOLOY
CEMENTED CARBIDES

METALLURGICAL PRODUCTS DEPARTMENT

GENERAL ELECTRIC

CARBOLOY® CEMENTED CARBIDES • MAN-MADE DIAMONDS
MAGNETIC MATERIALS • THERMISTORS • THYRITE® • VACUUM-MELTED ALLOYS

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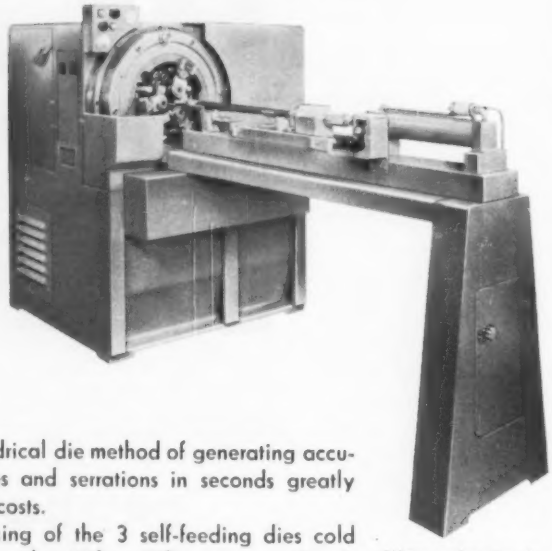
Reed 3-Cylindrical Die Machine

. . . produces splines faster with greater accuracy

It's Fast...

It's Accurate..

It's a Money Maker...



The Reed 3 cylindrical die method of generating accurate involute splines and serrations in seconds greatly reduces production costs.

The precise tracking of the 3 self-feeding dies cold forms the teeth with either 30° or 45° pressure angles. It gives greater tooth strength and better surface finish. The machine may be automated or equipped with a semi-automatic loading fixture.

Write today for detailed information.

If it can be rolled—write Reed.

REED RTD SM-175

REED ROLLED THREAD DIE CO.

Specialists in Thread and Form Rolling Tools and Equipment

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BUFFERS
Hammond Machinery Builders, Inc., Kalamazoo, Mich.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

BULLDOZERS, Metalforming
Birdsboro, Steel Foundry & Machine Co., Birdsboro, Pa.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio.
Erie Foundry Co., 1253 W. 12th St., Erie. Penna.

BURNISHING MACHINES
Hamilton Div., Baldwin-Lima-Hamilton Corp., Hamilton, Ohio
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.

BURRING MACHINES—See Deburring Machines

BURRS—See Files and Burrs, Rotary

BUSHINGS, Drill Jig
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Metal Corbides Corp., 6001 Southern Blvd., Youngstown 12, Ohio.
Universal Engrg. Co., Frankenmuth, Mich.

BUSHINGS, Hardened Steel
Universal Engrg. Co., Frankenmuth, Mich.

BUSHINGS, Non-ferrous and Powdered Metal
Bunting Brass & Bronze Co., 715 Spencer, Toledo Ohio.
Universal Engrg. Co., Frankenmuth, Mich.

CALIPERS, Spring, Firm-Joint, Transfer, Hermaphrodite, etc.—See Layout and Drafting Tools, Machinists' Small Tools

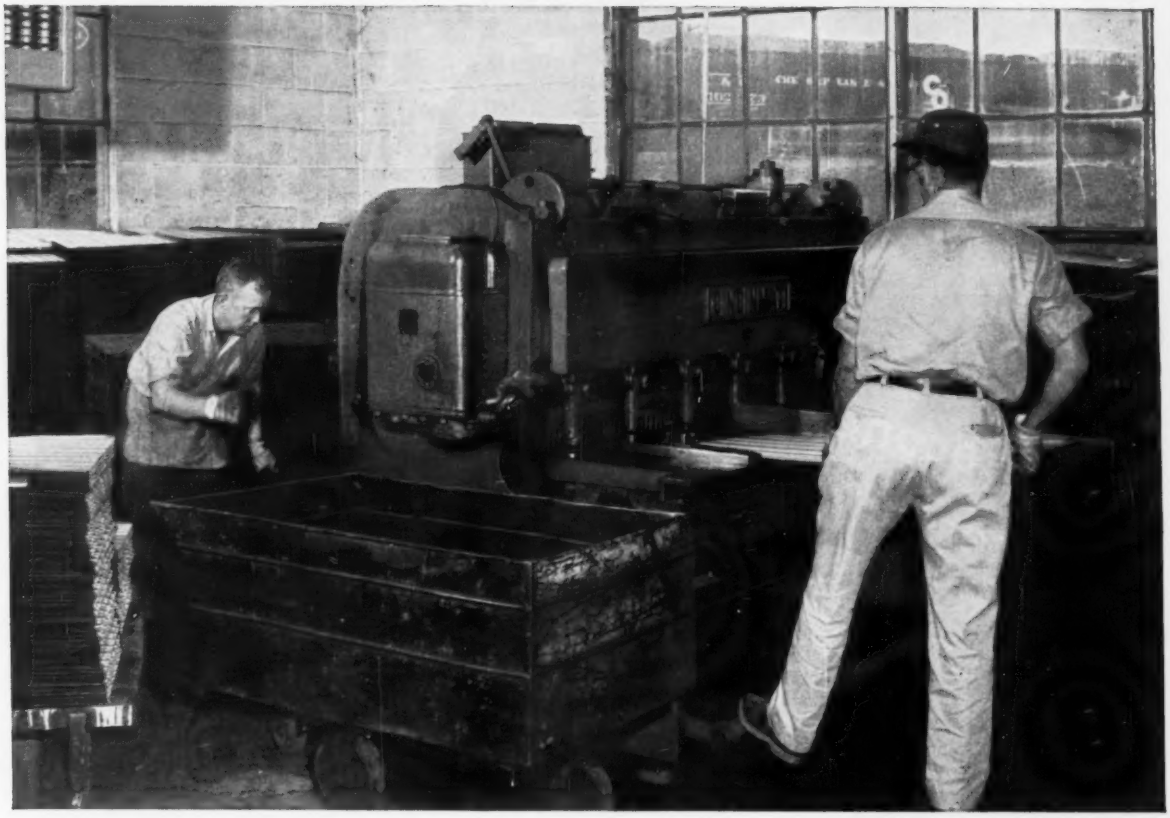
CALIPERS, Vernier
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., Des Plaines, Ill.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S. Co., Athol, Mass.

CAM CUTTING MACHINES
Cincinnati Milling & Grinding Mchs., Inc., Cincinnati 9, Ohio.
Cosa Corp., 405 Lexington Ave., New York, 17, N. Y.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Russell Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Van Norman Machine Co., 3640 Main St., Springfield 7, Mass.

CAMERAS, High Speed
Wollensak Optical Co., Rochester 21, N. Y.

CAM MILLING AND GRINDING MACHINES
American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio.
Landis Tool Co., Waynesboro, Pa.
Rowbottom Machine Co., Waterbury, Conn.

CAMS
Brown & Sharpe Mfg. Co., Providence, R. I.
Eisler Engrg. Co., Inc., 750 S. 13th, Newark 3, N. J.
Rowbottom Machine Co., Waterbury, Conn.



PRODUCTION: 10,000,000 cuts
MAINTENANCE COST: $896.00

This Cincinnati® Shear has been in constant service for ten years, cutting 18-gauge corrugated sheet, 1010 draw quality, for a prominent heating equipment manufacturer at an average rate of 4000 cuts a day. That adds up to more than a million strokes per year — or 10,000,000 strokes in ten years.

Accuracy has always been excellent. The machine has been "down" *only for blade changes*. Special blades are used in this operation, to eliminate distortion of the corrugations.

Cost of machine maintenance, including blade resharpening, has been $896.00 for the entire ten years. "This," says their production manager, "to my way of thinking, is very good performance." We agree. Yet this is not exceptional. Every Cincinnati® Shear is built to provide this kind of dependability and low maintenance, and we have hundreds of case histories to prove the point.

Specify Cincinnati® for all your shear requirements. Write Department D for Catalog S-7R.

Shapers / Shears / Press Brakes

THE CINCINNATI SHAPER CO.

Cincinnati 11, Ohio, U.S.A.

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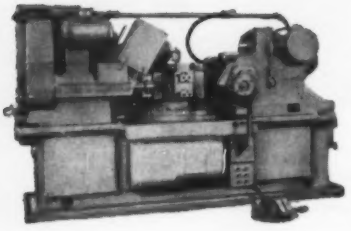


GOSS *and* DE LEEUW CHUCKING MACHINE

When any of the various functions for which this machine is designed are performed on it, no further machining is required. The job is finished.

The basic "1-2-3" method—exclusive with Goss & DeLeeuw—provides for gripping work in the chuck and machining all ends either simultaneously or in sequence. By eliminating several handlings and set-ups, the "1-2-3" method produces finished pieces at a fraction of the time and cost ordinarily required.

Send samples of your work for time estimates. Ask for illustrated literature containing detailed information.

GOSS & DeLEEUW

GOSS *and* DE LEEUW
MACHINE COMPANY, *KENSINGTON, CONN., U.S.A.*

CARBIDES
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
DoALL Co., Des Plaines, Ill.
Kennametal, Inc., Latrobe, Penna.
Linde Co., 30 E. 42nd St., New York 17, N. Y.
Metal Carbides Corp., Youngstown, Ohio.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Vascoloy-Ramet Corp., Waukegan, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.

CASTINGS, Die
American Brass Co., Waterbury 20, Conn.
Madison-Kipp Corp., Madison, Wis.

CASTINGS, Non-ferrous
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Mueller Brass Co., Port Huron 35, Mich.
Shenango Furnace Co., Dover, Ohio.
Textile Machine Works, Reading, Penna.
Vascoloy-Ramet Corp., Waukegan, Ill.

CASTINGS—Gray Iron, Malleable
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.
Malleable Castings Council, 1800 Union Commerce Bldg., Cleveland 14, Ohio.
Shenango Furnace Co., Dover, Ohio.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Textile Machine Works, Reading, Penna.

CASTINGS, Steel, Stainless, etc.
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.

CENTER-DRILLING MACHINES
Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

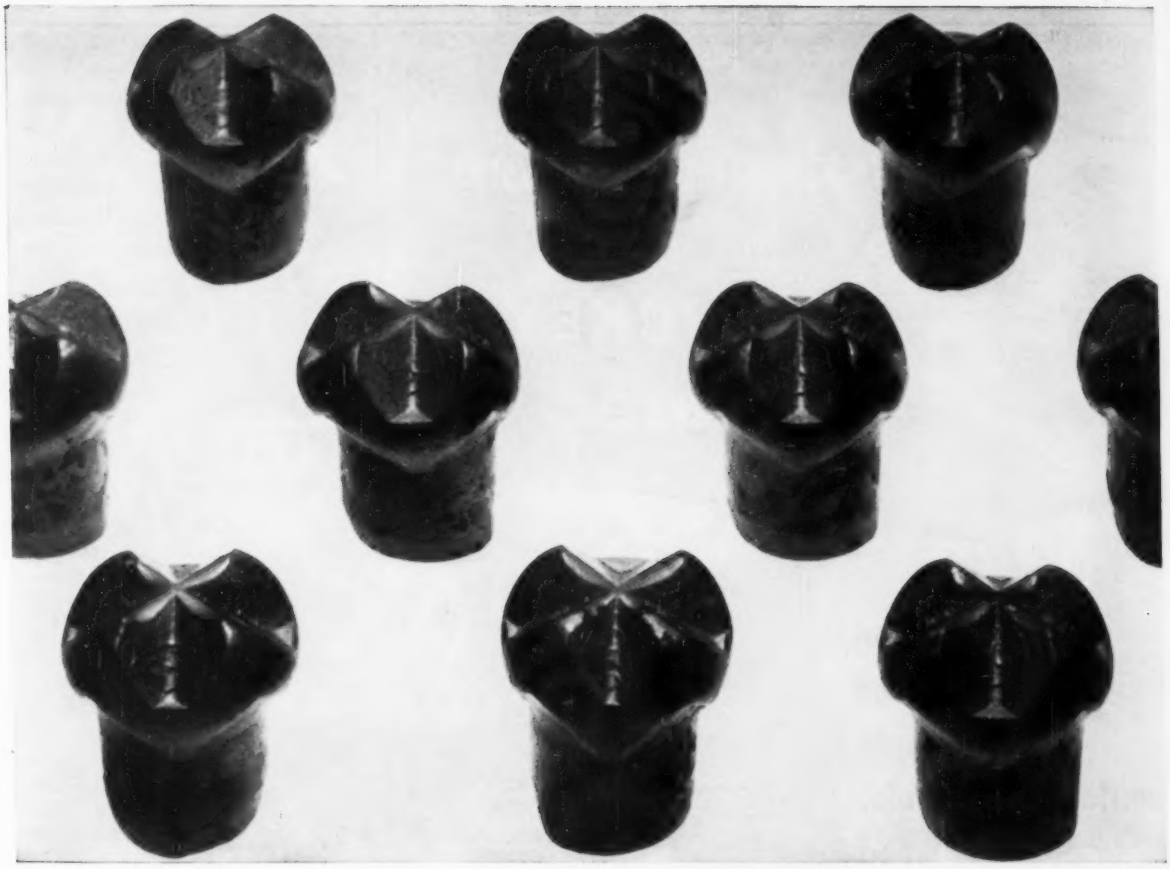
CENTER PUNCHES—See Machinists' Small Tools

CENTERS, Grinding Machines, Indexing Head and Lathe
DoAll Co., Des Plaines, Ill.
Houston Grinding & Mfg. Co., Inc., Houston 8, Texas.
Metal Carbides Corp., Youngstown, Ohio.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

CERAMIC TOOL MATERIAL—See Tool Material, Ceramic

CHAINS, Power Transmission and Conveyor
Boston Gear Works, 14 Hayward St., Quincy 71, Mass.

CHUCKING MACHINES, Multiple-Spindle Automatic
Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.
Burg Tool and Mfg. Co., Inc., 15001 S. Figueroa, Gardena, Calif.
Cross Co., P. O. Box 3835, Park Grove Postal Sta., Detroit 5, Mich.
Goss & DeLeeuw Mch. Co., Kensington, Conn.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.



It actually costs less to get uniform forged quality like this

THIS is an actual unretouched photo of rock bit forgings made from Timken® forging bars steel. It costs less to get this uniform forged quality when the steel is uniform. And Timken steel doesn't vary in structure, chemistry or dimension from heat to heat, bar to bar, order to order. You don't have to interrupt to make costly adjustments when you forge with Timken steel.

We take *extra* quality control steps to make Timken electric furnace fine alloy steel as uniform a steel as you can buy. For example, the Timken Company was the first U.S. steel maker to use the magnetic stirrer to keep molten alloys equally distributed, work slag constantly and keep temperature uniform. Ours was the first direct-reading spectrometer to insure exact composition down to the instant the furnace is tapped. What's more, The Timken Company's unique method of handling orders individually enables us to target procedures to meet your end-use requirement.

Why not insure a better forged product and save money doing it? Specify Timken fine alloy steel—the steel that's uniform! The Timken Roller Bearing Company, Canton 6, Ohio. Cable: "TIMROSCO". *Makers of Tapered Roller Bearings, Fine Alloy Steels and Removable Rock Bits.*

WHEN YOU BUY TIMKEN STEEL YOU GET:

1. Quality that's uniform from heat to heat, bar to bar, order to order
2. Service from the experts in specialty steels
3. Over 40 years experience in solving tough steel problems

TIMKEN® *Fine Alloy* STEEL

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an entirely new kind of metal-cutting tool!!!

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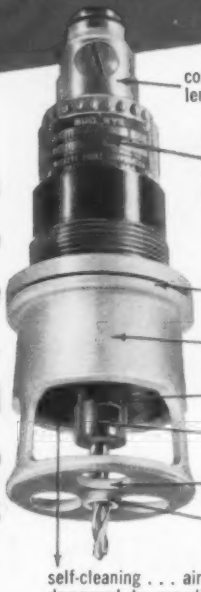
for precision cutting of the most intricate contours in metals, plastics, wood and honeycomb materials



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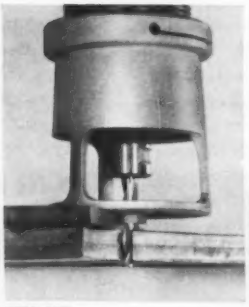

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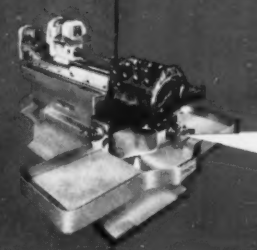

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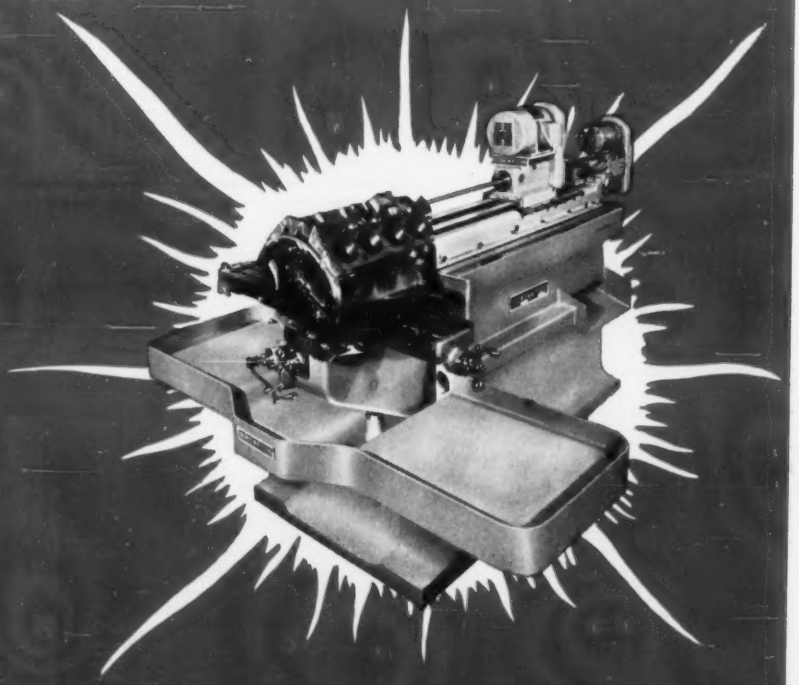

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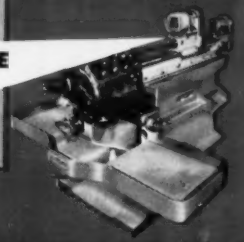

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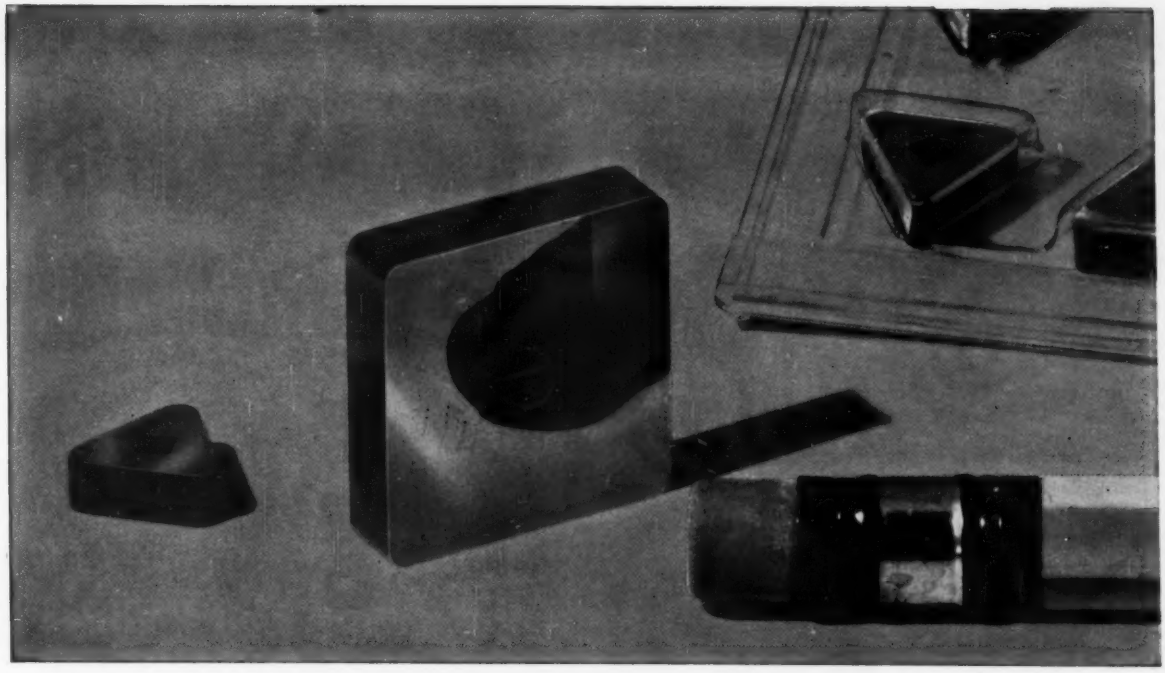

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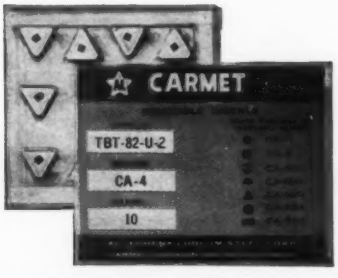

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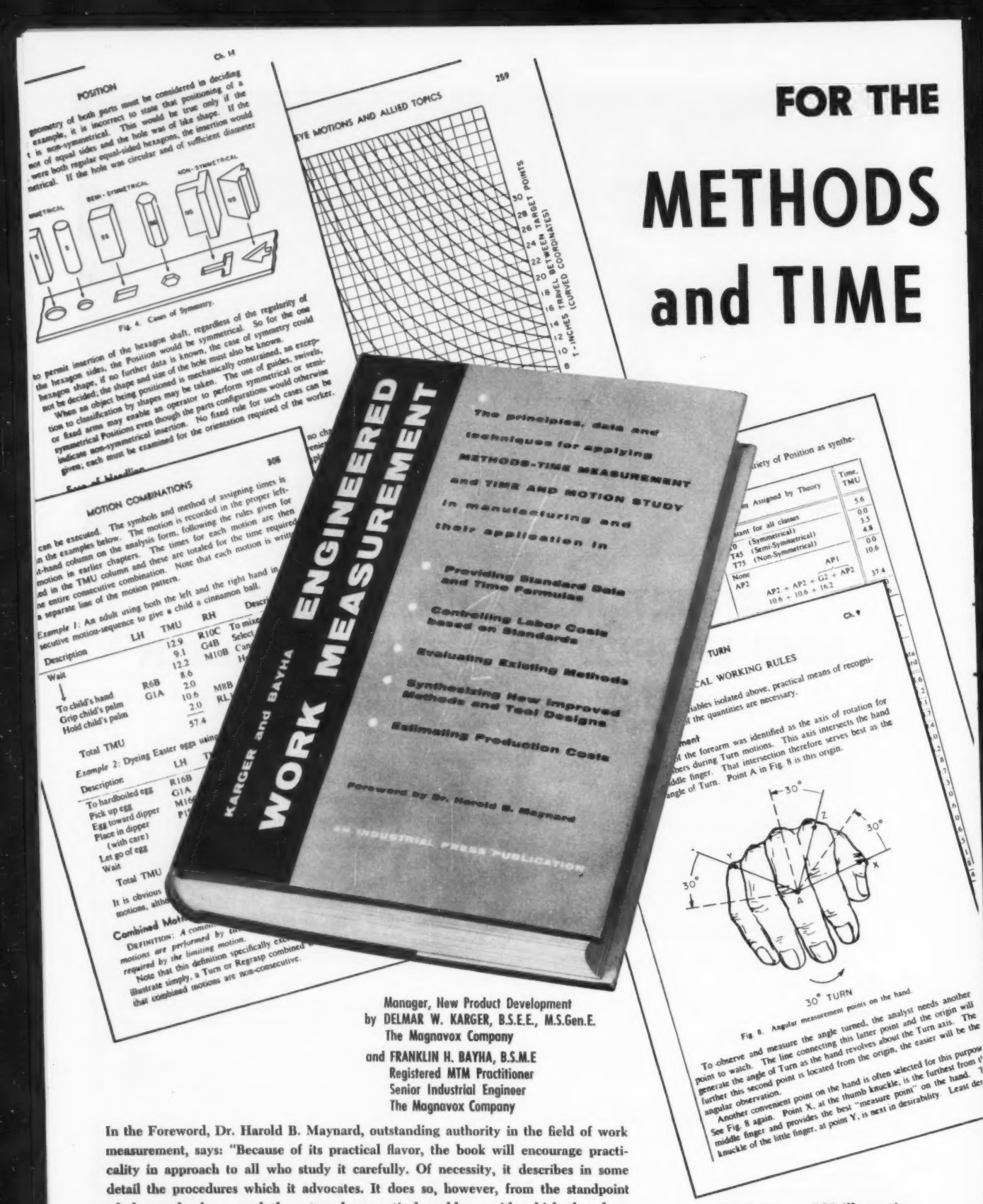
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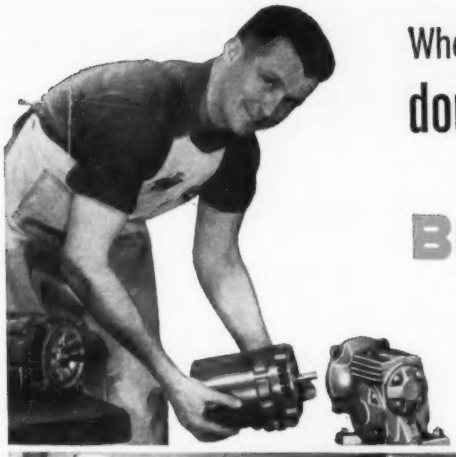

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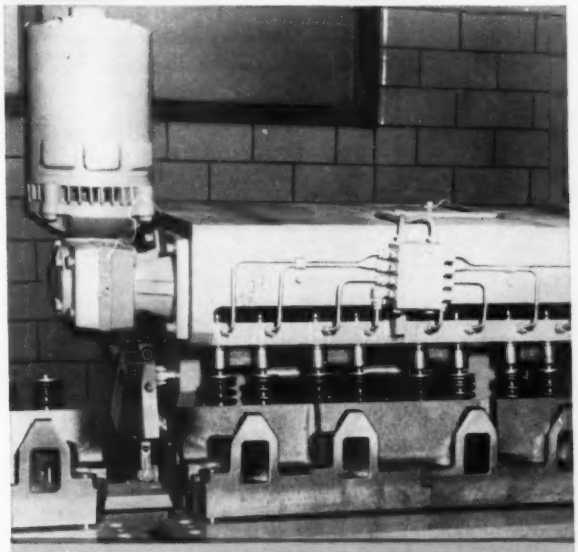

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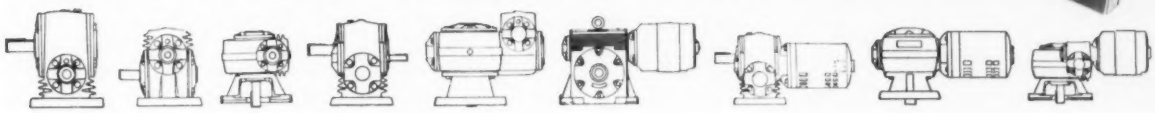

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Texas Co., 135 E. 42nd St., New York, N. Y.

CUTTING-OFF MACHINES, Lathe Type
Bardons & Oliver, Inc., 1133 W. Ninth St., Cleveland 13, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Modern Machine Tool Co., Jackson, Mich.

CUTTING-OFF SAWS, Abrasive Wheel
Johnson Manufacturing Co., Albion, Mich.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Simonds Abrasive Co., Tacony & Fraley Sts., Philadelphia 35, Penna.
Ty-Sa-Man Machine Co., Inc., 1093 White Ave., Knoxville, Tenn.
Wallace Supplies Mfg. Co., 1310 W. Diversey Parkway, Chicago 14, Ill.

CUTTING TOOLS—See Tool Material

CYLINDERS, Air
Hydraulic Press Mfg. Co., Mt. Gilead, Ohio.
Logansport Mch. Co., Inc., Logansport, Ind.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.
Tomkins-Johnson Co., Jackson, Mich.

CYLINDERS, Hydraulic
Barnes, John S., Corp., 301 S. Water St., Rockford, Ill.
Chicago Pneumatic Tool Co., New York 17, N. Y.
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Logansport Machine Co., Inc., Logansport, Ind.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Vickers, Inc., Detroit 32, Mich.

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Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Orban Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
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Danly Machine Specialties, Inc., 2100 South Laramie, Chicago 50, Ill.
Minster Machine Co., Minster, Ohio.
Verson Allsteel Press Co., 93rd St., and S. Kenwood Ave., Chicago, Ill.

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Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Kennametal, Inc., Latrobe, Penna.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Vascoloy-Ramet Corp., Waukegan, Ill.

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Lempco Industrial, Inc., Bedford, Ohio.
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U. S. Tool Co., Inc., 255 North 18th St., Ampere, E. Orange, N. J.
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DIE SINKING MACHINES—See Milling Machines, Die Sinking, etc.

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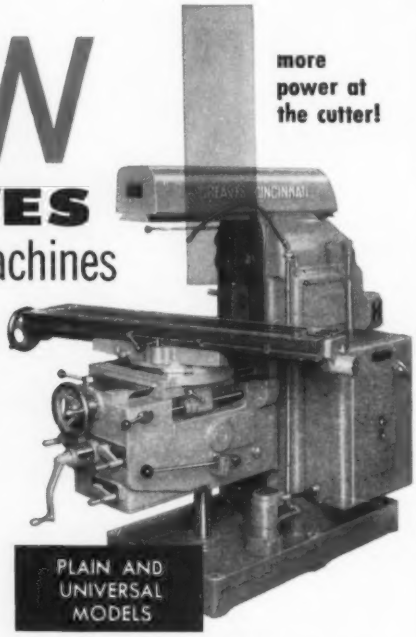

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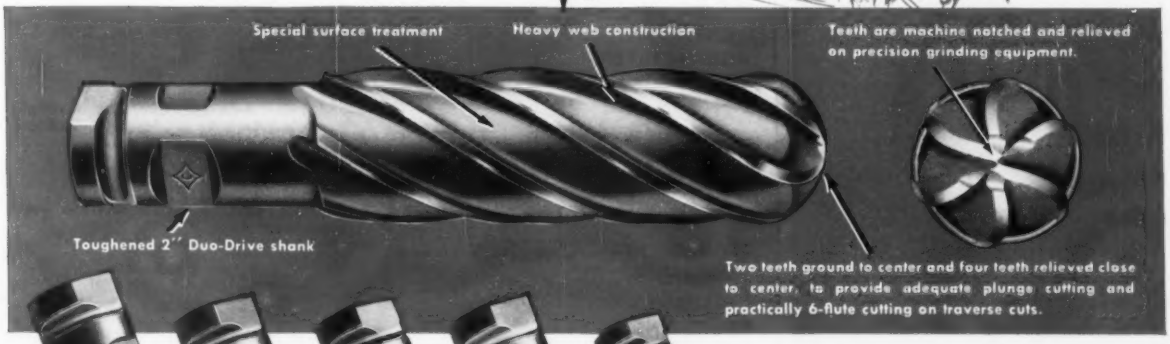
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Niagara Mch. & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Olofsson Corp., Lansing, Mich.
Ryerson & Son, Inc., Jos. T., 16th & Rockwell St., Chicago 8, Ill.
Vascoloy-Ramet Corp., Waukegan, Ill.
Verson Allsteel Press Co., 93rd St., and S. Kenwood Ave, Chicago, Ill.
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DIES, Self-opening Threading
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Jones & Lamson Mch Co., Springfield, Vt.
Landis Mch Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.

DIES, Thread Cutting—See Stocks and Dies

DIES, Thread Rolling
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Pratt & Whitney Co., Inc., West Hartford, Conn.
Reed Rolled Thread Die Co., P. O. Box 350, Worcester 1, Mass.
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Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio.
Metal Carbides Corp., Youngstown, Ohio.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
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Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.

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DoALL Co., Des Plaines, Ill.

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Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
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Baush Machine Tool Co., 15 Watson Ave., Springfield 1, Mass.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Burg Tool and Mfg. Co., Inc., 15001 S. Figueroa, Gardena, Calif.
Cross Co., P. O. Box 3835, Park Grove Postal Sta., Detroit 5, Mich.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Jarvis Corp., Middletown, Conn.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Leland Gifford Co., Box 989, Worcester 1, Mass.
National Automatic Tool Co., Richmond, Ind.
Snyder Corp., 3400 E. Fafayette Ave., Detroit 7, Mich.
Thriftmaster Products Corp., 1076 N. Plum St., Lancaster, Pa.
United States Drill Head Co., 616 Burns, Cincinnati, Ohio.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

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Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.
Kingsbury Mch. Tool Corp, Keene, N. H.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Snow Manufacturing Co., Bellwood, Illinois.

DRILL SLEEVES AND EXTENSION HOLDERS
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Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
DoAll Co., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Automatic Tool Co., Inc., S. 7th & N Sts., Richmond, Ind.

DRILLING ATTACHMENTS, Multiple Spindle—See Drill Heads, Multiple Spindle, and Vises, Machine

DRILLING AND BORING UNITS, Self-contained
Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
Barnes, W. F. & John Co., Rockford, Ill.
Baush Machine Tool Co., 15 Watson Ave., Springfield, Mass.
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Cross Co., P. O. Box 3835, Park Grove Postal Sta., Detroit 5, Mich.
Ettco Tool Co. Inc., 594 Johnson Ave, Brooklyn 37, N. Y.
Kaukauna Machine & Foundry Div., Biddings & Lewis Machine Tool Co., Kaukauna, Wis.
Kearney & Trecker Corp., 6784 W. National, Milwauke 14, Wis.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Leland-Gifford Co., Box 989, Worcester 1, Mass.
National Automatic Tool Co., S. 7th and N Sts., Richmond, Ind.
Olivetti Corp. of America, 42-33 Northern Blvd., Long Island City 1, N. Y.
Russell Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio.
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Townsend, H. P. Mfg. Co., Elmwood, Conn.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

DRILLING MACHINES, Automatic
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Barnes, W. F. & John Co., Rockford, Ill.
Baush Machine Tool Co., 15 Wason Ave., Springfield, Mass.
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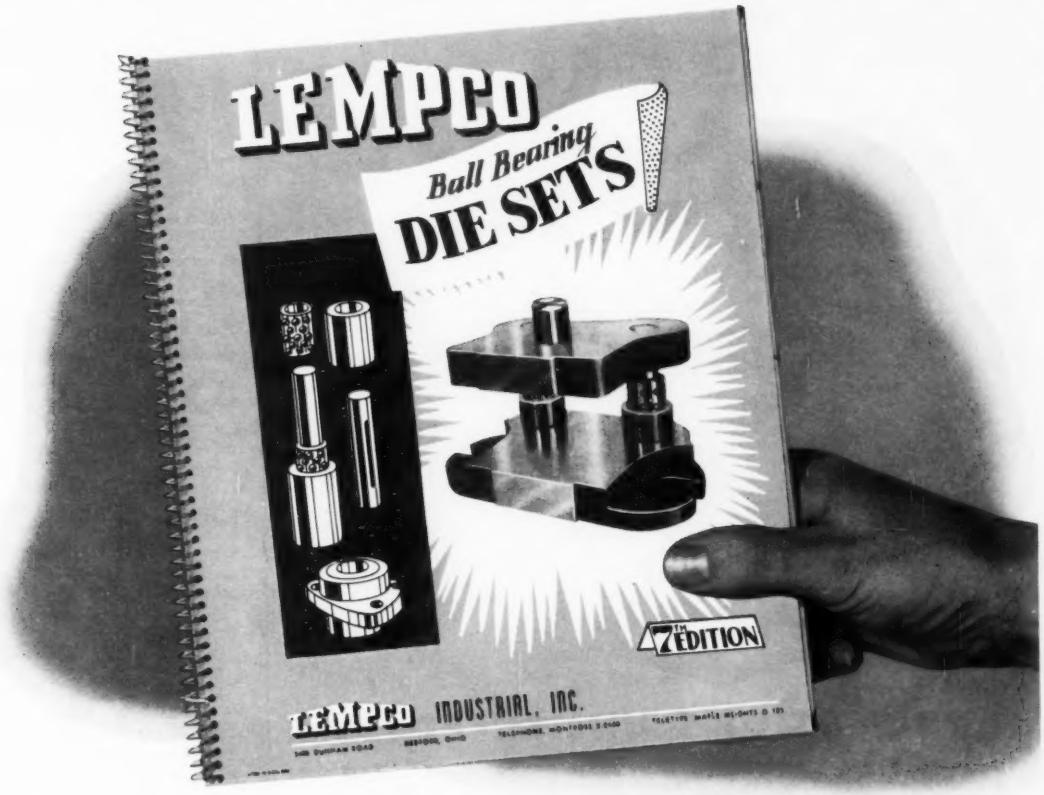

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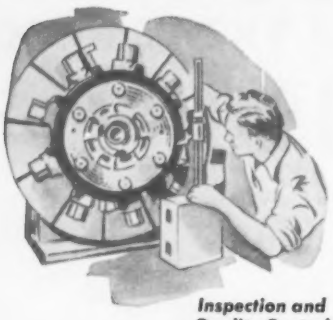
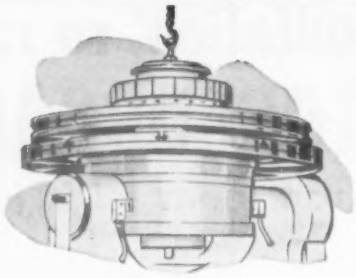
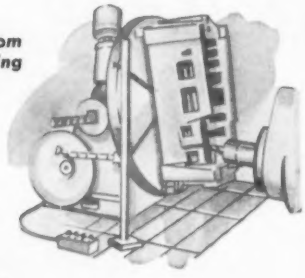


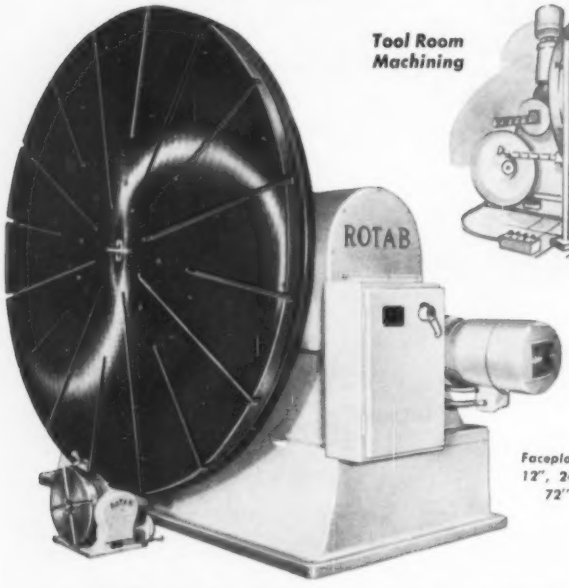
Inspection and Quality Control



Experimental and Tool Room Layout

Tool Room Machining





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Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Kingsbury Mch. Tool Corp., Keene, N. H.
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Leland-Gifford Co., Box 989, Worcester 1, Mass.
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Edlund Machinery Co., Div., Cortland, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Hamilton Tool Co., 834 9th St., Hamilton, Ohio.
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Leland-Gifford Co., Box 989, Worcester, Mass.
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Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
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Berthiez, Charles, 5 Rue Montalivet, Paris, France.
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Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Leland-Gifford Co., Box 989, Worcester 1, Mass.
National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.
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Barnes, W. F. & John Co., Rockford, Ill.
Baush Machine Tool Co., 15 Wason Ave., Springfield, Mass.
Bodine Corp., 317 Mt. Grove St., Bridgeport 5, Conn.
Buhr Machine Tool Co., 839 Greene St., Ann Arbor, Mich.
Burgmaster Corp., 15001 S. Figueroa, Gardena, Calif.
Burg Tool and Mfg. Co., Inc., 15001 S. Figueroa, Gardena, Calif.
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Davis & Thompson Co., 4460 124th St., Milwaukee 10, Wis.
Edlund Machinery Co., Div., Cortland, N. Y.
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Greenlee Bros. & Co., 136 12th St., Rockford, Ill.
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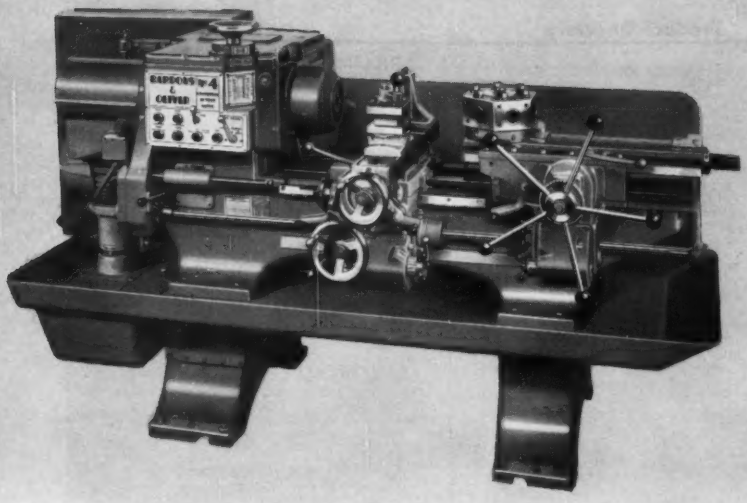

RAM TYPE TURRET LATHES		
Size	Bar Capacity	Swing Over Bed
No. 1 Geared Electric	5/8″ or 13/16″	11-1/2″
No. 2 Geared Electric	1″ or 1-1/4″	13-1/2″
No. 3 Universal	1-1/2″ or 2″	15-1/2″
No. 4 Universal	2″ or 2-1/2″	18-1/4″
No. 7 Universal	2-1/2″, 3″ or 4-1/2″	21-1/2″
SADDLE TYPE TURRET LATHE		
No. 21 Universal	2-1/2″, 3″ or 4-1/2″	21-1/4″

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Turret Lathes . . . .

Each of the six Turret Lathes listed is a completely different machine, designed specifically for one range of work. All units on each machine, including the cross slide and carriage, and the turret slide and saddle, are "sized" for a particular work range. Thus adequate strength and rigidity is provided, maximum productive capacity is offered, and at the same time minimum operator effort is required. A complete line of tooling and attachments is available for each size of machine.

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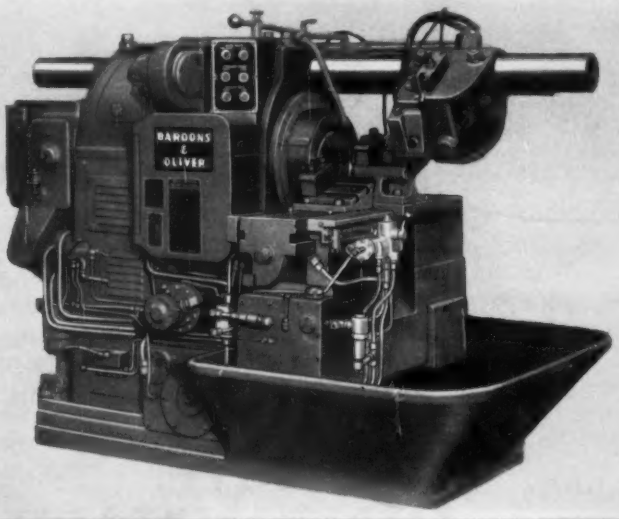
The Cutting-Off Lathes are designed to chamfer, form and cut off pipe, tubing, or bar stock with maximum efficiency. The number of pieces produced per hour often equals or exceeds that of much more expensive and complicated multiple spindle machines. Automatic loading tables, chamfer attachments, forming attachments, and automatic unloading devices are available for all sizes of Cutting-Off Lathes. These lathes are built as fully automatic, semi-automatic or hand operated.

CUTTING-OFF LATHES	
Size	Capacity
No. 32	2″
No. 33 and 34	3″, 4″ and 4-1/2″
No. 35 and 36	5-1/2″ and 6-5/8″
No. 38 and 39	8-5/8″ and 9-5/8″
No. 312 and 314	12-3/4″ and 14″
No. 316	16″



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Cincinnati Lathe & Tool Co., 3207 Disney St., Cincinnati 9, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., Cleveland 14, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Homestrand, Inc., Larchmont, N. Y.
Russell, Holbrook Henderson, Inc., 292 Madison Ave., New York 17, N. Y.

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Edlund Machinery Co. Div., Cortland, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, St., Cincinnati 23, Ohio.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio.
Leland-Gifford Co., Box 989, Worcester, Mass.
National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.
Snow Manufacturing Co., Bellwood, Illinois.
Olivetti Corp. of America, 42-33 Northern Blvd., Long Island City 1, N. Y.
Wales-Strippit, Inc., Akron, N. Y.

DRILLING MACHINES, Universal Radial
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DRILLING MACHINES, Upright
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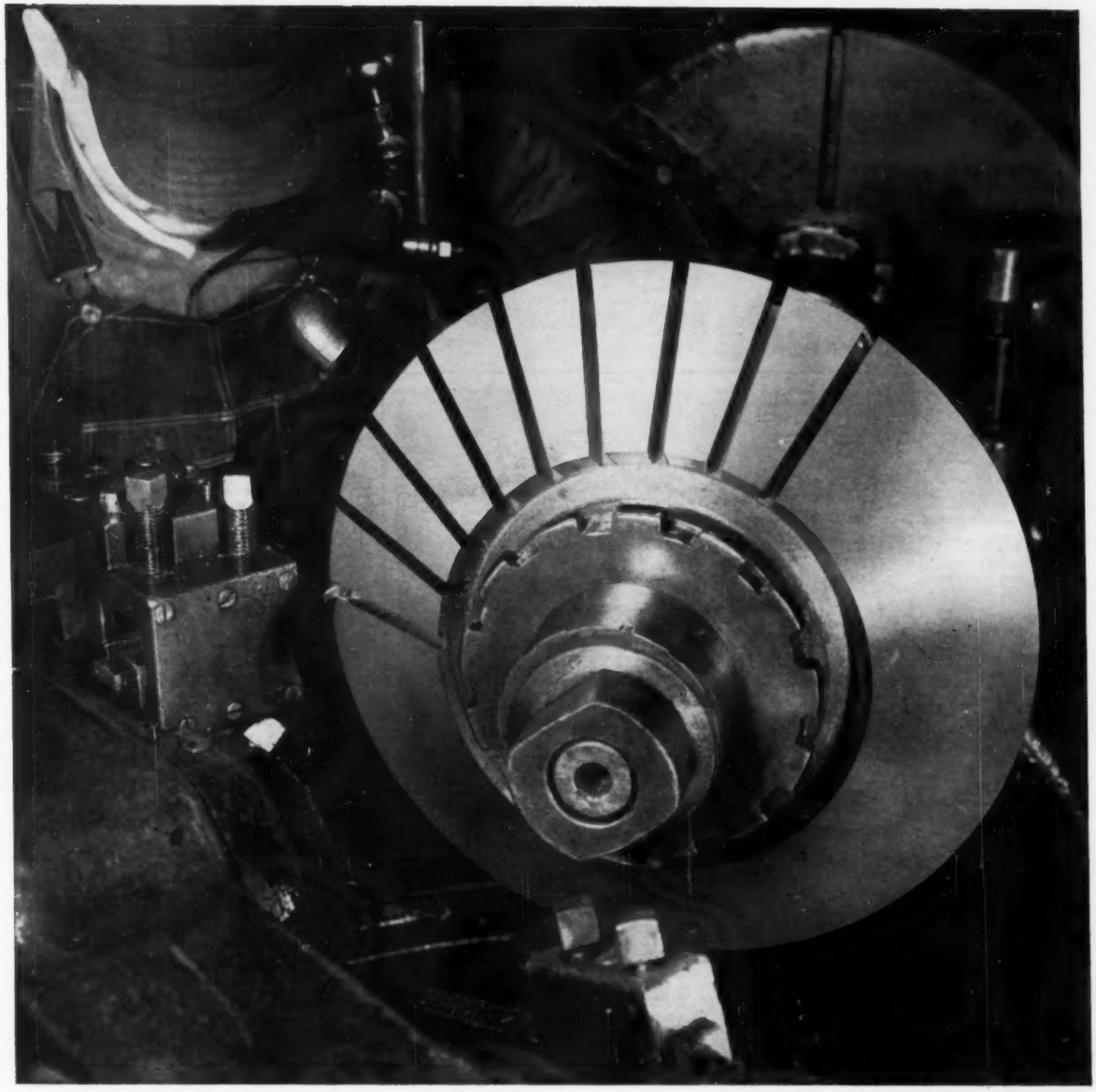
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Burgmaster Corp., 15001 S. Figueroa, Gardena, Calif.
Burg Tool and Mfg. Co., Inc., 15001 S. Figueroa, Gardena, Calif.
Cincinnati Bickford Div., Oakley, Cincinnati, Ohio.
Cincinnati Lathe & Tool Co., 3207 Disney St., Cincinnati 9, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Homestrand, Inc., Larchmont, N. Y.
Ingersoll Milling Mch. Co., 2442 Douglas St.,
Le Maire Machine Tool Co., 2657 S. Telegraph Rd., Dearborn, Mich.
National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.
Rehnberg-Jacobson Mfg. Co., 2135 Kishwaukee St., Rockford, Ill.
Snow Manufacturing Co., Bellwood, Ill.
Wales-Strippit, Inc., Akron, N. Y.

DRILLS, Center
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Circular Tool Co., 765 Allens Ave., Providence 5, R. I.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Cogsdill Twist Drill Co., Greenfield, Mass.
DoAll Co., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.

DRILLS, Core
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
DoAll Co., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Mohawk Tools, Inc., Mntpelier, Ohio.
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.



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Chicago Pneumatic Tool Co., New York 17 N. Y.

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Chicago Pneumatic Tool Co., New York 17, N. Y.

DRILLS, Ratchet
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Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio

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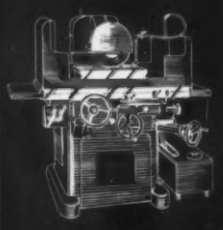
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
DoAll Co., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
Mohawk Tools, Inc., Montpelier, Ohio.



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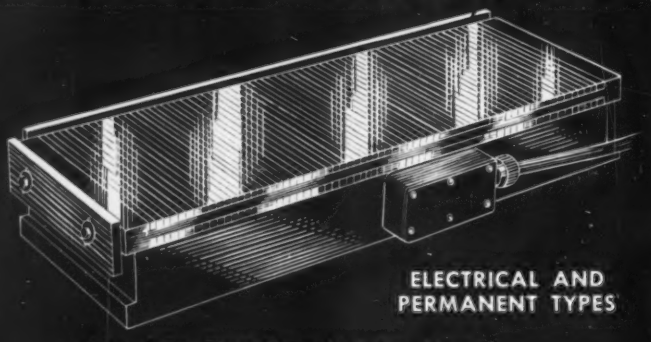

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Mohawk Tools, Inc., Montpelier, Ohio
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Threadwell Tap & Die Co., 16 Arch, Greenfield, Mass.

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Cogsdill Twist Drill Co., Greenfield, Mass.
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DUPLICATING ATTACHMENTS—See Tracing Attachments

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Gorton, Geo., Mach., 1321 Racine St., Racine, Wis.

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Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
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Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

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Cross Co., P. O. Box 3835, Park Grove Postal Sta., Detroit 5, Mich.
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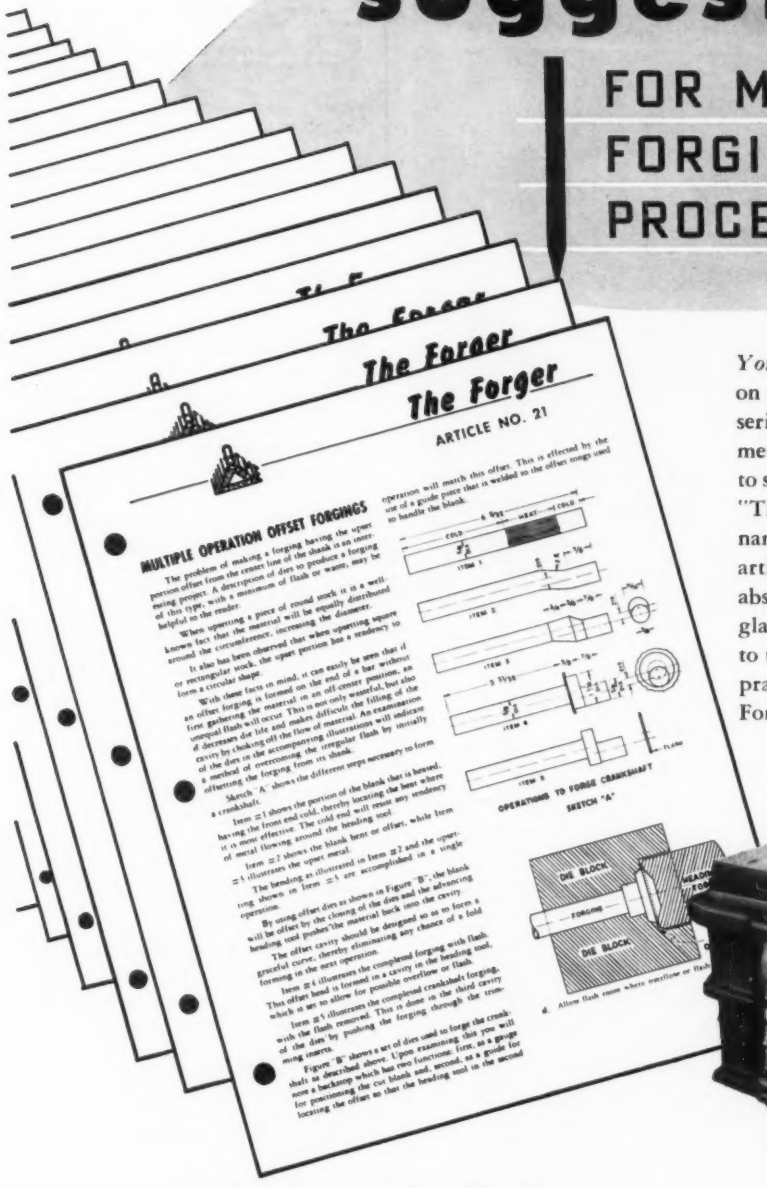
helpful suggestions

FOR MODERN FORGING PROCEDURE



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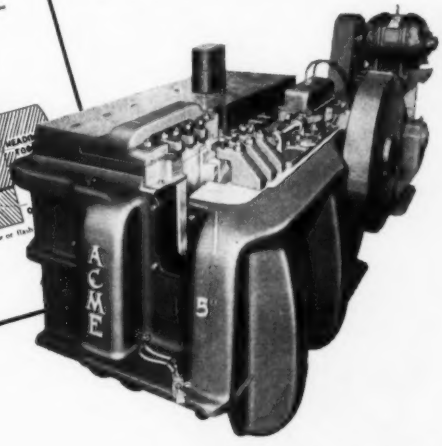

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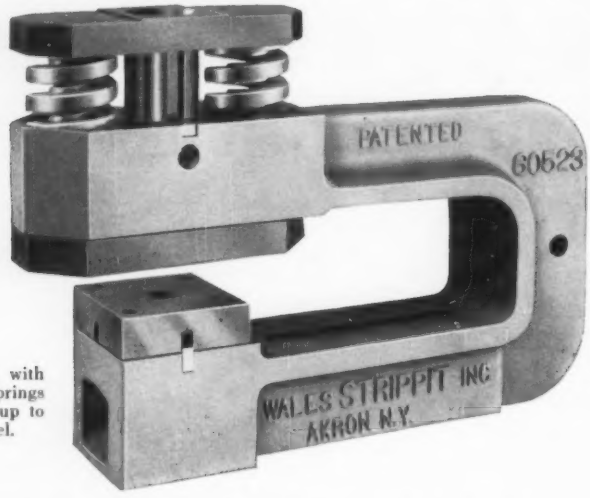

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1.250	.375
1.125	.500

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FILES, General-purpose, Swiss Pattern
DoALL Co., Des Plaines, Ill.

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Waterbury Farrel Foundry & Mch. Co., Waterbury, Conn.

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Mueller Brass Co., Port Huron 35, Mich.

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Mueller Brass Co., Port Huron 35, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

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Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., Cleveland 14, Ohio
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Gleason Works, 1000 University Ave., Rochester 3, N. Y.
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Ryerson, Jos. T. & Son, Inc., 16th and Rockwell St., Chicago 8, Ill.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio

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Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Boston Gear Works, 14 Hayward St., Quincy 71, Mass.
Cincinnati Gear Co., Wooster Pike and Marie mont Ave., Cincinnati, Ohio
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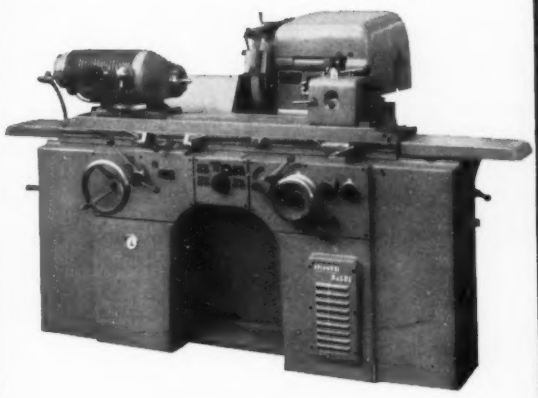
(*Continued on page 262*)

olivetti

high-precision grinding machines with hydraulic automatic infeed for traverse grinding and plunge grinding as standard equipment on all models.



3 types:

UNIVERSAL. *Swivelling wheelhead, swing-down internal grinding attachment, infinitely variable speed headstock.*

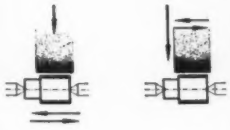
PRODUCTION. *Larger grinding wheel, more horsepower, non-swivelling wheelhead, 8-speed headstock.*

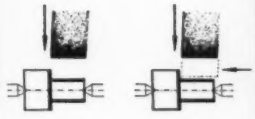
PLUNGE. *Similar to production type but with axially oscillating wheelhead and hand table control only.*

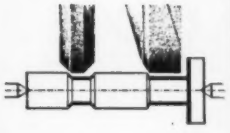
4 sizes:

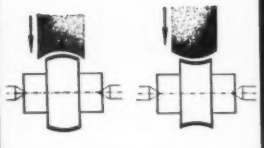
10", 12", 14", and 18" swings (with choice of lengths between centers).

Model R4-500 U shown at left. Universal type, 10" swing, 24" center distance.





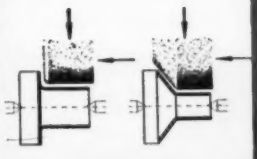




SOME STANDARD FEATURES OF OLIVETTI R4 UNIVERSAL GRINDERS:

- *Infinitely variable hydraulically controlled table speeds*
- *Table reversals within ± .0002" as short as 1/16"*
- *Table dwell 0 to 20 seconds*
- *Automatic precision infeed to .000050", right, left or both ends of traverse*
- *Thumb jog for taking .0001" cuts on diameter*
- *Separate automatic plunge feed 0 to .002"/second to positive stop*

For sales, service or information, write Olivetti Corporation of America, Machine Tool Division, 42-33 Northern Boulevard, Long Island City 1, New York. Or phone RAvenswood 1-7575.



For more data, circle this page number on inquiry card

Horsburgh & Scott Co., 5114 Hamilton Ave., Cleveland 14, Ohio
James D. O., Gear Mfg. Co., 1140 W. Monroe St., Chicago 7, Ill.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
New Jersey Gear Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.

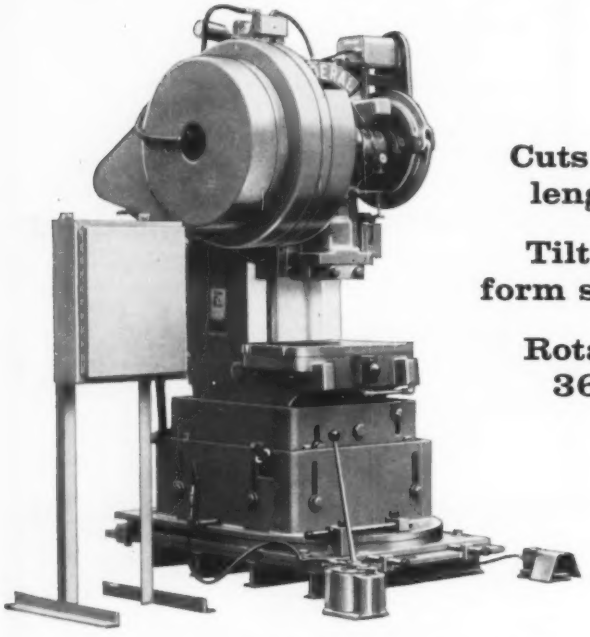
GRADUATING MACHINES
Gorton Geo., Mch. Co., 1321 Racine St., Racine, Wis.

GREASES—See Lubricating Oils and Greases

GRINDERS, Bench, Floor and Snag
Hammond Machinery Builders, Inc., Kalamazoo, Mich.
Jones & Lamson Mch. Co., Springfield, Vt.
Mummert-Dixon Co., Hanover, Pa.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

GRINDERS, Carbide Tool
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
DoAll Co., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hammond Machinery Builders, Inc., Kalamazoo, Mich.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Le Maire Machine Tool Co., 2657 S. Telegraph Rd., Dearborn, Mich.

New FEDERAL
"FLYING CUTOFF"
can increase production 100%



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Federal's new "Flying Cutoff" is adaptable to a variety of operations where rolling mills are used. It can double production . . . cut costs . . . help beat competition. Air-clutch control panel synchronizes press and mill speeds — permits cutting bars, channels, mouldings, angles and other shapes to *any length*—continuously. Custom fabricated base provides 360° rotation. Hydraulic power permits tilting at any angle. One-piece, machine tool grade cast iron frame, finest workmanship and other Federal features assure stamina for the most grueling jobs. Up to 100-ton capacity. Write for case histories and catalog today!

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Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.

GRINDERS, Die and Mold
DoAll Co., Des Plaines, Ill.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

GRINDERS, Drill Point
Consolidated Mch. Tool Div., 565 Blossom Rd., Rochester 10, N. Y.
Hammond Machinery Builders, Inc., Kalamazoo, Mich.
Oliver Instrument Co., 1410 E. Maumee, Adrian, Mich. (also drill point thinner)
Orban Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 4, Ohio.

GRINDERS, Face Mill
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Mattison Machine Works, 545 Blackhawk Park Ave., Rockford, Ill.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

GRINDERS, Knife and Shear
Hill Acme Co., 1201 W. 65th St. Cleveland 2, Ohio
Mattison Machine Works, Rockford, Ill.
Mummert-Dixon Co., Hanover, Pa.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

GRINDERS, Portable Electric
Chicago Pneumatic Tool Co., New York 17, N. Y.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio

GRINDERS, Portable Pneumatic
Chicago Pneumatic Tool Co., New York 17, N. Y.
Madison-Kipp Corp., Madison, Wis.

GRINDERS, Tap
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hammond Machinery Builders, Inc., Kalamazoo, Mich.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.

GRINDERS, Tool and Cutter
Barber-Colman Co., 1300 Rock St., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling and Grinding Mchs., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gallmeyer & Livingston Co., 336 Straight Ave., S. W., Grand Rapids 4, Mich.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Gorton, Geo., Mch. Co., 1321 Racine St., Racine, Wis.
Landis Tool Co., Waynesboro, Pa.
LeBlond, R. K., Mch. Tool Co. Madison and Edwards Rds., Cincinnati 18, Ohio
Mummert-Dixon Co., Hanover, Pa.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio
Norton Co., 1 New Bond St., Worcester 6, Mass.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place Jersey City 2, N. J.
Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio

GRINDERS, Toolpost
Cosa Corp., 305 Lexington Ave., New York 17, N. Y.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

GRINDING GAGES—See Gages, Grinding

GRINDING MACHINES, Abrasive Belt
Hammond Machinery Builders, Inc., Kalamazoo, Mich.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Mattison Mch. Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

GRINDING MACHINES, Broach

Gallmeyer & Livingston Co., 336 Straight, S. W. Grand Rapids 2, Mich.
National Broach & Mch. Co., 5600 St. Jean, Detroit 13, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Thompson Grinder, 1534 W. Main, Springfield, Ohio

GRINDING MACHINES, Cam

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Van Norman Machine Co., 3640 Main St., Springfield 7, Mass.

GRINDING MACHINES, Centerless

Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Landis Tool Co., Waynesboro, Pa.
Van Norman Machine Co., 3640 Main St., Springfield 7, Mass.

GRINDING MACHINES, Crankshaft

Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
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Van Norman Machine Co., 3640 Main St., Springfield 7, Mass.

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Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gallmeyer & Livingston Co., 336 Straight, S. W., Grand Rapids 2, Mich.
Hammond Machinery Builders, Inc., Kalamazoo, Mich.
Landis Tool Co., Inc., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Sheffield Corp., Box 893, Dayton 1, Ohio
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 4, Ohio
Van Norman Machine Co., 3640 Main St., Springfield 7, Mass.

GRINDING MACHINES, Disc

Brown & Sharpe Mfg. Co., Providence, R. I.
Gardner Machine Co., Beloit, Wis.
Mattison Machine Co., Beloit, Wis.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

GRINDING MACHINES, Gear

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
Gear Grinding Machine Co., 3901 Christopher St., Detroit 11, Mich.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio

GRINDING MACHINES, Internal

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gallmeyer & Livingston Co., 336 Straight, S. W. Grand Rapids 2, Mich.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Standard Electrical Tool Co. 2488-90 River Rd., Cincinnati, Ohio
Van Norman Machine Co., 3640 Main St., Springfield 7, Mass.
Wicaco Machine Corp., Wayne Junction, Philadelphia, Pa.

GRINDING MACHINES, Jig

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock St., Cincinnati 23, Ohio
Gallmeyer & Livingston Co., 336 Straight S. W., Grand Rapids 2, Mich.
Moore Special Tool Co., Inc., 740 Union Ave., Bridgeport, Conn.

GRINDING MACHINES, Profile

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Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch. Co., Springfield, Vt.
Sheffield Corp., Box 893, Dayton 1, Ohio

GRINDING MACHINES, Roll

Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.

GRINDING MACHINES, Surface Reciprocating

Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling and Grinding Mchs., Inc. Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
DoAll Co., Des Plaines, Ill.
Gallmeyer & Livingston Co., 336 Straight, S.W. Grand Rapids 4, Wis.
Gardner Machine Co., Beloit, Wis.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Homestrand, Inc., Larchmont, N. Y.
Mattison Machine Works, Rockford, Ill.
Norton Co., 1 New Bond St., Worcester 6, Mass.
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Adjusts under full air pressure

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There is less down time, greater accuracy. 40% less weight means that chuckers start quicker, stop quicker, with less brake wear. 40% lighter jaws means less centrifugal force, surer grip at high speeds. And gibs to take up wear should *triple the useful precision chuck life.*

Send for complete facts. See why *"It pays to chuck with Buck."*

BUCK TOOL COMPANY

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For more data, circle this page number on inquiry card

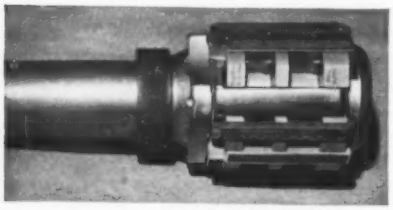
WHY MICROHONING* TOOLS ASSURE

ECONOMY — PRECISION — PRODUCTION

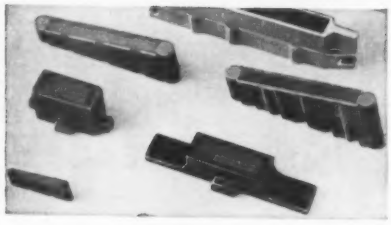
COST FACTORS (labor, maintenance, scrapped parts, productivity, etc.) DETERMINE MACHINE TOOL EFFICIENCY.

To Minimize These Cost Factors, Micromatic has developed Microhoning tools that offer a new concept in metalworking. This concept (known as the Microhoning process) assures controlled abrading, efficient stock removal, accurate generation of geometry and size, and produces uniform, functional surface finishes.

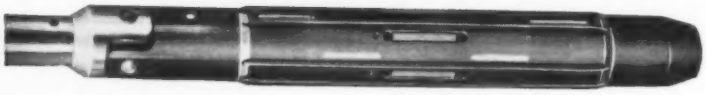
Because Microhoning removes inaccuracies of preceding operations, it is usually the final stock removal operation. Therefore, Microhoning tools are designed and applied to produce high precision, assure a minimum of scrap and protect the user's investment in previous processing operations.



New! Tru-Float tool has a universal joint within the abrading unit. This design provides maximum accuracy and float, uniform abrading and surface finish, less wear of abrasives, retention of original bore location, and minimum stock removal to correct inaccuracies.



Micromold assemblies have plastic or soft metal shells that minimize tool wear and protect the edges of abrasive sticks from the harsh dressing action of extremely rough bores. This abrasive stick design eliminates many parts previously required to hold abrasives and expand the tool.



Tool designed for Microhoning tandem bores has plastic guides between banks of abrasives to stabilize the tool as it passes over bore interruptions.

Because use of the proper tool is so important, Micromatic designs Microhoning tools to suit the individual work piece, and integrates tool design with machine and fixturing to provide the ultimate in operating efficiency.

*Registered U.S. Pat. Off.

MICROMATIC HONE CORP.

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Mattison Machine Works, Rockford, Ill.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio
Norton Co., 1 New Bond St., Worcester 6, Mass.
Orban Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio
Walker, O. S. Co., Inc., Worcester, Mass.

GRINDING MACHINES, Thread

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Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch. Co., Springfield, Vt.
Landis Machine Co. (Centerless), Waynesboro, Pa.
Orban Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sheffield Corp., Box 893, Dayton 1, Ohio

GRINDING MACHINES, Universal

Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gallmeyer & Livingston Co., 336 Straight, S.W., Grand Rapids 2, Mich.
Gorton Mch. Co., Geo., 1321 Racine St., Racine, Wis.
Jones & Lamson Mch Co., Springfield, Vt.
Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Olivetti Corp. of America, 42-33 Northern Blvd., Long Island City 1, N. Y.
Orban Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.

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Jones & Lamson Mch. Co., Springfield, Vt.
Metal Carbides Corp., Youngstown, Ohio
Moore Special Tool Co., Inc., 740 Union Ave., Bridgeport 7, Conn.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Sheffield Corp., Box 893, Dayton 1, Ohio

GRINDING WHEELS

Blanchard Machine Co., 64 State St., Cambridge, Mass.
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Gardner Machine Co., Beloit, Wis.
Macklin Co., Jackson, Mich.
Metal Carbides Corp., Youngstown, Ohio
Navan Products Inc., 900 N. Sepulveda Blvd., Los Angeles 45, Calif.
Norton Co., 1 New Bond St., Worcester 6, Mass.

GROOVING TOOLS, Internal

Kennametal, Inc., Latrobe, Penna.
Simonds Abrasive Co., Tacony & Fraley Sts., Philadelphia 35, Penna.
Waldes Kohinoor, Inc., 47-16 Austel Pl., Long Island City 1, N. Y.
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.

HAMMERS, Drop—See Forging Hammers

HAMMERS, Portable Pneumatic

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.

HAMMERS, Power

Chambersburg Engrg. Co., Chambersburg, Pa.
Edlund Mchry. Co. Div., Cortland, N. Y.

Erie Foundry Co, 1253 W. 12th St., Erie Penna.
Yoder Co., 5504 Walworth Ave., Cleveland 2, Ohio

HARDNESS TESTERS
Shore Instrument & Mfg. Co., 90-35C Van Wyck Exp., Jamaica 35, N. Y.

HEAT-TREATING EQUIPMENT — See Annealing Furnaces, Flame Hardening Machines, Induction-Heating Equipment

HOBS
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Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Twist Drill & Tool Co., Rochester, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.

HOISTS, Air
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.

HOISTS, Electric
Shepard Niles Crane & Hoist Corp., Montour Falls, N. Y.

HONING MACHINES
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Micromatic Hone Corp., 8100 Schoolcraft Ave., Detroit 38, Mich.
Moline Tool Co., 102-120th St., Moline, Ill.
Superior Hone Corp., 1623 Elreno St., Elkhart, Ind.
Van Norman Machine Co., 3640 Main St., Springfield 7, Mass.

HONING STONES
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Micromatic Hone Corp., 8100 Schoolcraft Ave., Detroit 38, Mich.
Norton Co., 1 New Bond St., Worcester 6, Mass.

HOSE
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Schrader's Son, A., 470 Vanderbilt Ave., Brooklyn 38, N. Y.

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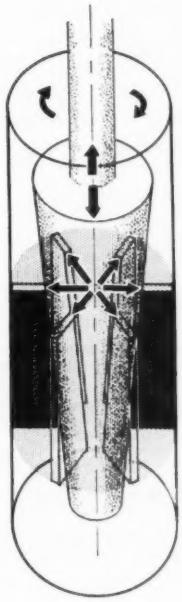
Bethlehem Steel Corp., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Bliss, E. W., Co., 1375 Raff Rd., E. W. Canton, Ohio
Burg Tool and Mfg. Co., Inc., 15001 S. Figueora, Gardena, Calif.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Denison Engineering, Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., Erie, Pa.
Hydraulic Press Mfg. Co., Mount Gilead Ohio
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Michigan Drill Head Co., Detroit 34, Mich.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Northern Hydraulics & Mch. Corp., Melrose Park, Ill.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Vickers Incorporated, Div. of Sperry Rand Corp., 1402 Oakman Blvd., Detroit, Mich.
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.

HOW MICROHONING* TOOLS PROVIDE

ECONOMY — PRECISION — PRODUCTION

When a precision stock removal process minimizes cost factors (labor, maintenance, scrapped parts, etc.) then volume production at lower cost per piece is possible. Here's how the distinctive design and performance of Microhoning tools provide all three—economy, precision and production.



EFFICIENT OPERATION

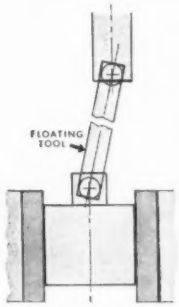
Micromatic expands, rotates and reciprocates the abrading tool in the bore. Through this controlled combination of pressure and movements, abrasives are self-dressing for effective and continuous cutting action. Long abrasive sticks are evenly spaced around the tool to keep it stable. They effectively bridge surface irregularities and generate a geometrically true cylinder.

REDUCES OPERATOR COSTS

Micromatic "Adjusting Heads" give operator complete and positive control of tool expansion. Or, automatic controls can be used to perform all tool adjustment and gaging. They assure accurate duplication in every part produced.

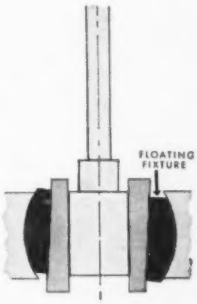
MINIMUM MAINTENANCE

Micromatic tools are designed for durability, especially at all stress points and joints. Plastic or soft metal holders prolong abrasive life, greatly reduce tool wear.



MAINTAINS ORIGINAL BORE LOCATION

Micromatic either floats the tool or the work holding fixture so tool and work piece can automatically align themselves. This assures cutting-unit rotation coincides with neutral axis of bore.



WRITE FOR LITERATURE

Micromatic produces tools best suited to the production of individual work pieces. And properly integrates the tool with machine and fixturing for peak productivity at lowest cost per piece produced.

*Registered U.S. Pat. Off.

MICROMATIC HONE CORP.
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For more data, circle this page number on inquiry card

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HIGH FREQUENCY
INDUCTION
HEATING
UNITS
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BRAZING
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MELTING
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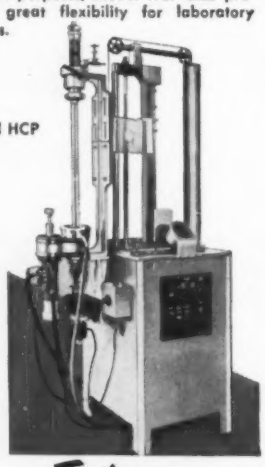
Lepel induction heating equipment represents the most advanced thought in the field of electronics . . . the most practical and efficient source of heat developed for numerous industrial applications.
You are invited to send samples of work with specifications. Our engineers will process and return the completed job with full data and recommendations without cost or obligation.

FLOATING ZONE UNIT FOR METAL REFINING AND CRYSTAL GROWING

A new floating zone fixture for the production of ultra-high purity metals and semi-conductor materials. Purification or crystal growing is achieved by traversing a narrow molten zone along the length of the process bar while it is being supported vertically in vacumm or inert gas. Designed primarily for production purposes, Model HCP also provides great flexibility for laboratory studies.

Model HCP



Features

- **A smooth, positive mechanical drive system with continuously variable up, down and rotational speeds, all independently controlled.**
- **An arrangement to rapidly center the process bar within a straight walled quartz tube supported between gas-tight, water-cooled end plates. Placement of the quartz tube is rather simple and adapters can be used to accomodate larger diameter tubes for larger process bars.**
- **Continuous water cooling for the outside of the quartz tube during operation.**
- **Assembly and dis-assembly of this system including removal of the completed process bar is simple and rapid.**

Electronic Tube Generators from 1 kw to 100 kw.
Spark Gap Converters from 2 kw to 30 kw.

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Barnes, W. F. & John Co., 201 S. Waterford St., Rockford, Ill.
Denison Engineering, Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Le Maire Machine Tool Co., 2657 S. Telegraph Rd., Dearborn, Mich.
Michigan Drill Head Co., Detroit 34, Mich.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Vickers Incorporated, Div. of Sperry Rand Corporation, 1402 Oakman Blvd., Detroit, Mich.

INDEXING and SPACING EQUIPMENT

Brown & Sharpe Mfg. Co., Providence, R. I.
Eisler Engrg. Co., Inc., 750 South 13th St., Newark, N. J.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Opto-Metric Tools, Inc., 137 Varick St., New York, N. Y.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Van Norman Machine Co., 3640 Main St., Springfield 7, Mass.

INDICATOR BASES, Magnetic

Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Starrett, L. S. Co., Athol, Mass.

INDICATORS, Dial

Ames, B. C., Waltham 54, Mass.
Brown & Sharpe Co., Providence, R. I.
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
National Automatic Tool Co., S. 7th - N. Sts., Richmond, Ind.
Starrett, The L. S. Co., Athol, Mass.

INDICATORS, Speed

Brown & Sharpe Mfg Co., Providence, R. I.
Buhr Machine Tool Co., 839 Greene St., Ann Arbor, Mich.
Starrett, The L. S. Co., Athol, Mass.

INDICATORS, Test

Brown & Sharpe Mfg. Co., Providence, R. I.
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
National Automatic Tool Co., S. 7th & N. Sts., Richmond, Ind.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Starrett, The L. S. Co., Athol, Mass.

INDUCTION HEATING EQUIPMENT

Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Lepel High Frequency Laboratories, Inc., Woodside 77, N. Y.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.

INTENSIFIERS, Hydraulic

Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Logansport Mch. Co., Inc., Logansport, Ind.
Oilgear Co., 1560 W Pierce St., Milwaukee 4, Wis.

JACKS, Planer—See Set-up Equipment

JIG BORERS

American Sip Corp., 100 E. 42nd St., New York 17, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
DeVlieg Machine Co., Fair St., Royal Oak, Mich.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio
Homestrand, Inc., Larchmont, N. Y.
Moore Special Tool Co., Inc., 740 Union Ave., Bridgeport, Conn.
Orban, Kurt., Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

JIGS AND FIXTURES

Bath, Cyril Co., Aurora & Solon Road, Solon, Ohio
Columbus Die Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio
Hartford Special Mchry. Co., 287 Homestead Ave., Hartford, Conn.
Ingersoll Milling Machine Co., 505 Fulton Ave., Rockford, Ill.
Metal Carbides Corp., Youngstown 12, Ohio
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio

KEYSEATERS

Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio
Bliss, E. W. Co., Canton, Ohio
Mitts & Merrill, 1809 S. Water St., Saginaw, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.

KNURLING TOOLS

Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago 46, Ill.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Reed Rolled Thread Die Co., P. O. Box 350, Worcester 1, Mass.
Williams J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

LAPPING MACHINES

Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Crane Packing Co., 6400 Oakton St., Morton Grove, Ill.
DoALL Co., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Gleason Works, 1000 Univedsity Ave., Rochester, N. Y.
Micromatic Hone Corp., 8100 Schoolcraft Ave., Detroit 38, Mich.
Norton Co., 1 New Bond St., Worcester 6, Mass.

LATHE ATTACHMENTS

Buhr Machine Tool Co., 839 Greene St., Ann Arbor, Mich.
Clearing Div., of U. S. Industries, Inc., 6499 W. 65th St., Chicago 38, Ill.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Jones & Lamson Mch. Co., 512 Clinton St., Springfield, Vt.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Nebel Machine Tool Corp., 3401 Central Pkwy., Cincinnati 25, Ohio.
Sheldon Mch. Co., Inc., 4258 N. Knox Ave., Chicago 41, Ill.
Sidney Mch. Tool Co., Sidney, Ohio
Williams, J. H. & Co, 400 Vulcan St., Buffalo 7, N. Y.

LATHES, AUTOMATIC—See Chucking Machines

LATHES, Axle

Buhr Mch. Tool Co., Ann Arbor, Mich.
Consolidated Mch. Tool Div., Farrel-Birmingham Co., Inc., Rochester 10, N. Y.
Hamilton Div., Baldwin-Lima-Hamilton Corp. Hamilton, Ohio
Monarch Mch. Tool Co., Oak St., Sidney, Ohio
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sidney Mch. Tool Co., Sidney, Ohio
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

LATHES, Bench

Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.

EASY AS IT LOOKS!

NEW ADD-A-UNIT MANIFOLDS WITH ELECTRICAL PLUG-INS SIMPLIFY MULTIPLE AIR INSTALLATIONS

Here's an important air valve "first"! We have now engineered our MAC Dual-Seal valves with optional *add-a-unit manifold bases.* Two to ten of the bases can be combined quickly and easily—giving you a single, compact, inexpensive manifold to suit your exact requirements, take up far less space.

As the picture shows, the manifold forms common inlet, common exhaust and common conduit channels. The side and bottom cylinder ports come in either ⅜" or ½" sizes. And if you wish to use more than one pressure, "add-a-units" let you isolate valves and feed pressure from each end. Bottom inlet ports are available, too.

Now, we also have simplified valve wiring. Each manifold base has female receptacles (see picture) with attached plug-in leads for quick, positive connections. The valve body has male terminals pre-wired to the MACsolenoid. To connect, just plug in the body to the base. It's as easy as plugging in a lamp . . . and it lets you replace a valve without any additional wiring. MAC design also offers standardized bodies, bases and solenoids (single or double); circular air-flow; and the valve is J.I.C. specified. Put Dual-Seal efficiency in your air operations now! Write for complete information or phone your MAC representative.

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MECHANICAL AIR CONTROLS, INC.

10030 Capital, Oak Park, Detroit 37, Michigan

Export Representative: Ad Auriema, 85 Broad St., NYC 4

MAC

FEEDCISION

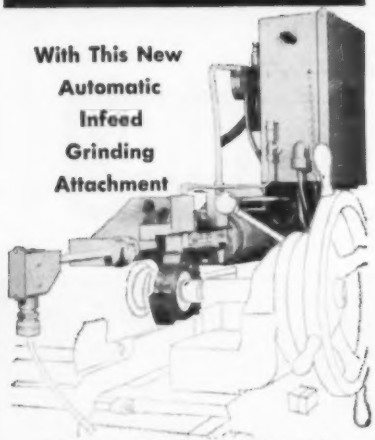
INCREASES CENTERLESS GRINDING PRODUCTION

200%

YES

300%

With This New Automatic Infeed Grinding Attachment



Utmost precision in grinding and duplicate sizing. Sizing dial is graduated in (.00001) one hundredth of a thousandth of an inch. No hydraulic checking cylinder to change feed rate when oil is cold. No checking of oil level or refilling of hydraulic checking cylinder. Three (3) different feed rates are available in one unit for the fastest, most efficient, and precise sizing in a centerless grinder.

CAN BE USED FOR TRU-FEED AS WELL AS INFEED for close sizing. Ideally located push button control station consists of Stop-Button, Caution Pilot Light, and a selector switch for set up or auto grinding positions. **CATALOG** — Write for it today!

MODERN DEVICES

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Bullard Co., Bridgeport 6, Conn.
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Hamilton Div., Baldwin-Lima-Hamilton Corp., Hamilton, Ohio

LATHES, Copying, Duplicating — See Lathes, Duplicating

LATHES, Crankshaft

Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds, Cincinnati 18, Ohio
Snyder Tool & Engrg. Co., 3400 E. Lafayette Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

LATHES, Double-End

Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio
Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2351 11th St., Rockford, Ill.

LATHES, Duplicating

Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Monarch Machine Tool Co., 27 Oak St., Sidney Ohio

LATHES, Engine, Manufacturing

American Tool Works Co., Pearl and Eggleston Aves., Cincinnati, Ohio
Buhr Machine Tool Co., 839 Greene St., Ann Arbor, Mich.
Cincinnati Lathe & Tool Co., 3207 Disney St., Cincinnati 9, Ohio
Clearing Div., of U. S. Industries, Inc., 6499 W. 65th St., Chicago 38, Ill.
Consolidated Mch. Tool Div, Blossom Road Rochester 10, N. Y.
Hendey Mch. Div., Barber Colman Co., Rockford, Ill.
Homestrand, Inc., Larchmont, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Nebel Machine Tool Corp., 3401 Central Pkwy., Cincinnati 25, Ohio.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
Sidney Mch. Tool Co., Sidney, Ohio

LATHES, Engine, Toolroom

American Tool Works Co., Pearl and Eggleston Aves., Cincinnati, Ohio
Buhr Machine Tool Co., 839 Greene St., Ann Arbor, Mich.
Cincinnati Lathe & Tool Co., 3207 Disney St., Cincinnati 9, Ohio
Clearing Div., of U. S. Industries, Inc., 6499 W. 65th St., Chicago 38, Ill.
Hardinge Bros. Inc., 1420 College Ave., Elmira, N. Y.
Hendey Mch. Div., Barber Colman Co., Rockford, Ill.
Homestrand, Inc., Larchmont, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Logan Engineering Co., 4901 Lawrence Ave., Chicago 30, Ill.
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio
Nebel Machine Tool Corp., 3401 Central Pkwy., Cincinnati 25, Ohio.
Orban, Kurt Co., Inc., 42 Exchange Place Jersey City 2, N. J.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
Sidney Mch. Tool Co., Sidney, Ohio

LATHES, Gap

Cincinnati Lathe & Tool Co., 3207 Disney St. Cincinnati 9, Ohio
Clearing Div., of U. S. Industries, Inc., 6499 W. 65th St., Chicago 38, Ill.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Nebel Machine Tool Corp., 3401 Central Pkwy., Cincinnati 25, Ohio.

LATHES, Hollow Spindle

LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
South Bend Lathe Works Inc., 425 E. Madison St., South Bend, Ind.

LATHES, Roll

American Tool Works Co., Pearl and Eggleston Aves., Cincinnati 2, Ohio
Bliss, E. W., Co., Canton, Ohio
Hamilton Div., Baldwin-Lima-Hamilton Corp., Hamilton, Ohio
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Monarch Mch. Tool Co., Oak St., Sidney, Ohio
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.

LATHES, Speed, Second-operation

Gisholt Machine Co, 1245 E Washington Ave., Madison 10, Wis.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Monarch Mch. Tool Co., Oak St., Sidney, Ohio
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sheldon Mch. Co., 4258 N. Knox Ave., Chicago 41, Ill.
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 4, Ohio

LATHES, Spinning

Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Lodge & Shipley Co., The, Cincinnati 25, Ohio
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.

LATHES, Toolroom—See Lathes, Engine, Toolroom

LATHES, Turret, Automatic

Bullard Co., Bridgeport 2, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis
Jones & Lamson Mch. Co., 512 Clinton St., Springfield, Vt.
King Machine Tool Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
National Acme Co., 170 E. 131st St., Cleveland 3, Ohio.
New Britain Mch. Co., New Britain-Gridley Dive., New Britain, Conn.

LATHES, Turret, Ram Type Saddle Type

Bardons & Oliver, Inc., 1133 W. Ninth St., Cleveland 13, Ohio
Bullard Co., Bridgeport 2, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Brothers, Inc., 1420 College Ave., Elmira, N. Y.
Jones & Lamson Mch. Co., 512 Clinton St., Springfield, Vt.
New Britain Mch. Co., New Britain-Gridley Div., New Britain, Conn.
Sheldon Mach. Co., Inc., 4258 N Knox Ave., Chicago 41, Ill.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio

LATHES, Turret, Vertical—See Boring Mills, Vertical

LAYOUT and DRAFTING TOOLS

Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
Starrett, L. S., Co., Athol, Mass.

LEAD SCREWS & SPLINES, Ball Bearing

Saginaw Steering Gear Div., General Motors Corp., Saginaw, Mich.

LEVELS

Starrett, The L. S. Co., Athol, Mass.

LIMIT SWITCHES—See Switches, Limit

LUBRICATING OILS and GREASES

Cities Service Oil Co., 70 Pine St., New York, N. Y.
Houghton, E. F. & Co., 303 W. Lehigh Ave., Philadelphia 33, Penna.

(*Continued on page 270*)

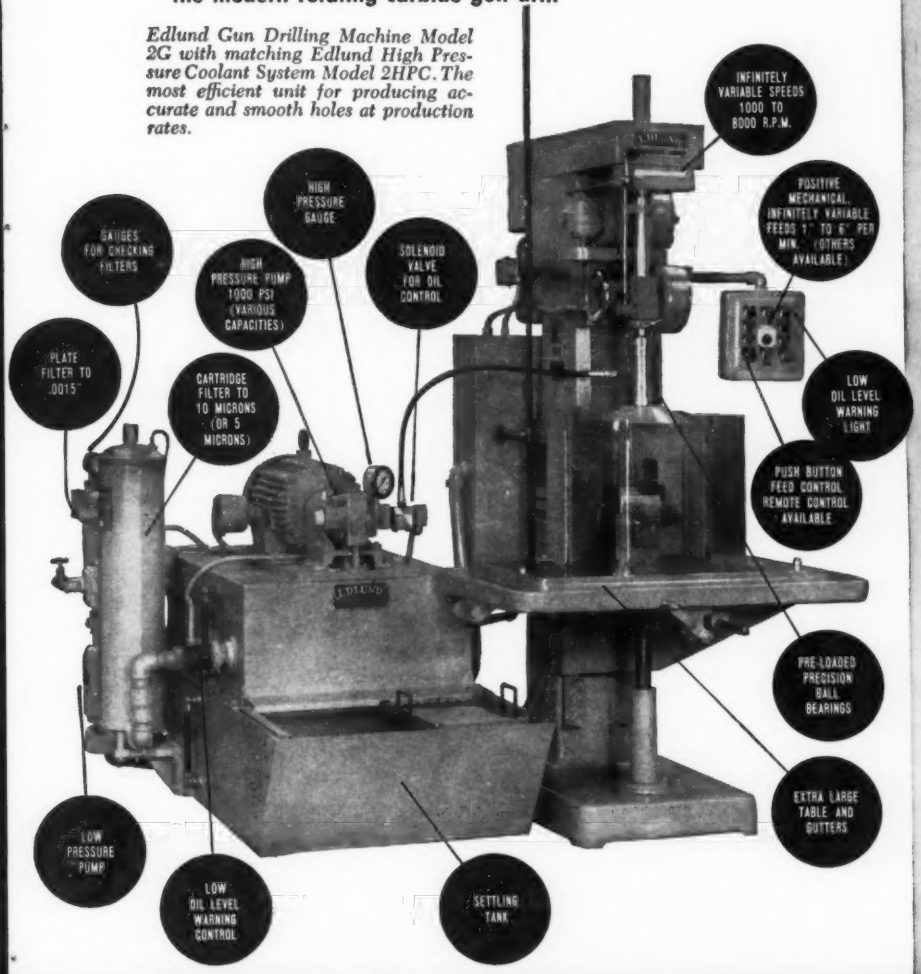
NOW! SOLVE DIFFICULT HOLE DRILLING

with EDLUND GUN DRILLING MACHINE Model 2G

An entirely new and specially designed Vertical Gun Drilling Machine, based on Edlund's years of drilling experience, brings you —

- **The only *Vertical* Gun Drilling Machine for general purpose work**
- **The most economical Gun Drilling Machine on the market**
- **Easy drilling of difficult problem holes — odd shaped pieces, all types of material — aluminum, cast iron, bronze, tool steel, stainless, and other steels**
- **Deep, accurate holes with fine finish**
- **The only machine offering features to utilize the full potential of the modern rotating carbide gun drill**

Edlund Gun Drilling Machine Model 2G with matching Edlund High Pressure Coolant System Model 2HPC. The most efficient unit for producing accurate and smooth holes at production rates.


INFINITELY VARIABLE SPEEDS 1000 TO 8000 R.P.M.
POSITIVE MECHANICAL INFINITELY VARIABLE FEEDS 1" TO 6" PER MIN. (OTHERS AVAILABLE)
HIGH PRESSURE GAUGE
GAUGES FOR CHECKING FILTERS
HIGH PRESSURE PUMP 1000 PSI (VARIOUS CAPACITIES)
SOLENOID VALVE FOR OIL CONTROL
PLATE FILTER TO .0015"
CARTRIDGE FILTER TO 10 MICRONS (OR 5 MICRONS)
LOW OIL LEVEL WARNING LIGHT
PUSH BUTTON FEED CONTROL REMOTE CONTROL AVAILABLE
PRE-LOADED PRECISION BALL BEARINGS
EXTRA LARGE TABLE AND GUTTERS
LOW PRESSURE PUMP
LOW OIL LEVEL WARNING CONTROL
SETTLING TANK

SPECIAL CONSTRUCTION

Pre-loaded precision ball bearing spindle keeps thrust and radial tolerances to minimum; rigidity of construction throughout to take advantage of the latest development in gun type drilling.

HIGH PRESSURE COOLANT SYSTEM

Adequate Filtration (Two filters plus settling tank guarantees clean oil essential for gun drilling) *Oil Sight Gauge *Low Level Warning System *Indicating Gauges and Provision for cooling by water or refrigeration *Capacities—reservoir 140 gals.—pump 10, 20 or 40 gals. per min. *Pressures—1000 psi.

FEATURES

- **Infinitely Variable Speeds 1000 to 8000 R.P.M. (Others available)**
- **Infinitely Variable Feeds 1" to 6" per min. (Others available)**
  (DC Motor—Positive Mechanical Control
  Remote or automatic cycling available)
- **Finishes—4 to 8 Micro Inches in most materials**
  (Eliminates Second Operations: Reaming, Grinding, Honing)
- **Capacity—⅜" in steel; Traverse of Spindle 8"; Traverse of Table 15"**
- **Single or Multiple Spindle Machines**

Contact the Edlund Representative in your area or write direct for Bulletin 2G and complete information on the Vertical Gun Drilling Machine.

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SPECIAL CONTRACT JOB WORK FOR GUN DRILLING CAN BE ARRANGED WITH EDLUND. SEND PART, BLUEPRINT AND REQUIREMENTS.

EDLUND
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Division of Harsco Corporation

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Standard Oil Co. (Indiana), 910 S Michigan, Chicago, Ill.
Texas Co., 135 E. 42nd St., New York, N. Y.

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Madison-Kipp Corp., Madison, Wis.

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Miles Mchry. Co., 2025 E. Genessee Ave., Saginaw, Mich.
Motch & Merryweather Mchy. Co., 888 E. 70th St., Cleveland 3, Ohio
Van Keuren Co., Watertown 72, Mass.

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DoALL Co., Des Plaines, Ill.
Niagara Mch. & Tool Wks., 637-697 Northland Ave., Buffalo 11, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Van Keuren Co., 176 Waltham St., Watertown 72, Mass.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

MANDRELS—See Arbors and Mandrels

MARKING MACHINES and DEVICES

Gorton Mch. Co., 1321 Racine St., Racine, Wis.

MATERIAL-HANDLING TRUCKS—See Trucks, Material Handling

MEASURING MACHINES

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sheffield Corp., 721 Springfield St., Dayton, 1, Ohio
Van Keuren Co., 176 Waltham St., Watertown 72, Mass.

MEASURING WIRES—Thread, Spline, Gear

Sheffield Corp., Dayton 1, Ohio
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
Van Keuren Co., 176 Waltham St., Watertown 72, Mass.

MICROMETER HEADS

Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
DoALL Co., Des Plaines, Ill.
Starrett, The L. S., Co., Athol, Mass.

MICROMETERS, Outside, Inside, Depth

Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
DoALL Co., Des Plaines, Ill.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Van Keuren Co., 176 Waltham St., Watertown 72, Mass.

MICROSCOPES, Toolmakers'

Bausch & Lomb Optical Co., Rochester, N. Y.
DoALL Co., Des Plaines, Ill.
Opto-Metric Tools, Inc., 137 Varick St., New York, N. Y.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

MILLING MACHINE ATTACHMENTS

Bridgeport Mches., Inc., 500 Lindley St., Bridgeport 6, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling & Grinding Mches. Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Gorton, George Mch. Co., 1110 W. 13th St., Racine, Wis.
Greaves Mch. Tool Div., 2011 Eastern Ave., Cincinnati 2, Ohio
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Nichols, W. H. Co., Waltham 54, Mass.
Sheldon Mch. Co., Inc., 4258 N Knox Ave., Chicago 41, Ill.
Van Norman Machine Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Automatic

Buhr Machine Tool Co., 839 Greene St., Ann Arbor, Mich.
Cincinnati Milling Machine Co., Cincinnati, Ohio
Consolidated Machine Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Ingersoll Milling Machine Co., 505 Fulton Ave., Rockford, Ill.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Nichols, W. H. Co., Waltham 54, Mass.
Olivetti Corp. of America, 42-33 Northern Blvd., Long Island City 1, N. Y.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, E. Orange, N. J.

MILLING MACHINES, Bed Type, Simplex, Duplex

Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
Cincinnati Milling & Grinding Mches., Inc., 470 Marburg Ave., Cincinnati 9, Ohio
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Espen-Lucas Mch. Wrks., Front St., and Girard Ave., Philadelphia, Pa.
Ingersoll Milling Machine Co., 505 Fulton Ave., Rockford, Ill.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Motch & Merryweather Mchy. Co., 888 E. 70th St., Cleveland 3, Ohio
Nichols, W. H. Co., Waltham 54, Mass.
Olivetti Corp. of America, 42-33 Northern Blvd., Long Island 1, N. Y.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, E. Orange, N. J.
Van Norman Machine Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Bench, Hand

Hardinge Bros. Inc., 1420 College Ave., Elmira, N. Y.

MILLING MACHINES, Circular, Continuous

Consolidated Mch. Tool Corp., Rochester, N. Y.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14. Wis.
Espen Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
Ingersoll Milling Machine Co., 505 Fulton Ave., Rockford, Ill.
Nichols, W. H. Co., Waltham 54, Mass.
Olivetti Corp. of America, 42-33 Northern Blvd., Long Island City 1, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Layfayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2351 11th St., Rockford, Ill.

MILLING MACHINES, Die Sinking, Duplicating, Profiling

Bridgeport Mches., Inc., 500 Lindley St., Bridgeport 6, Conn.
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Clearing Div., of U. S. Industries, Inc., 6499 W. 65th St., Chicago 38, Ill.
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
G & L and Hypro Div., Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Gorton, George, Machine Co., 1110 W. 13th St., Racine, Wis.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Nichols, W. H. Co., Waltham 54, Mass.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Knee Type, Horizontal, Plain, Universal

Brown & Sharpe Mfg. Co., Providence, R. I.
Bullard Co., Bridgeport 6, Conn.
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Clearing Div., of U.S. Industries, Inc., 6499 W. 65th St., Chicago 38, Ill.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gorton Geo., Mch., Co., 1110 W. 13th St., Racine, Wis
Greaves Machine Tool Div., 2009 Eastern Ave., Cincinnati, Ohio
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Ingersoll Milling Machine Co., 505 Fulton Ave., Rockford, Ill.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Nichols, W. H. Co., Waltham 54, Mass.
Sheldon Machine Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.

MILLING MACHINES, Knee Type Ram

Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
Gorton Mch. Co., 1321 Racine St., Racine, Wis.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Van Norman Machine Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Knee Type Rise and Fall

Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Nichols, W. H. Co., Waltham 54, Mass.
Orban, Kurt Co., 42 Exchange Place, Jersey City, N. J.

MILLING MACHINES, Knee Type Turret

Gorton Mch. Co., 1321 Racine St., Racine, Wis.

MILLING MACHINES, Knee Type, Vertical

Bridgeport Mches., Inc., 500 Lindley St., Bridgeport 6, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling & Grinding Mches,, Inc. 4701 Marburg Ave., Cincinnati 9, Ohio
Clearing Div., of U. S. Industries, Inc., 6499 W. 65th St., Chicago 38, Ill.
Cosa Corp., 450 Lexington Ave., New York 17, N. Y.
Gorton, George, Mch. Co., 11110 W. 13th St., Racine, Wis.
Homestrand, Inc., Larchmont, N. Y.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, N. Y.
Nichols, W. H. Co., Waltham 54, Mass.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.

MILLING MACHINES, Planer Type

Berthiez, Charles, 5 Rue Montalivet, Paris, France
Consolidated Mch, Tool Div., Blossom Road, Rochester 10, N. Y.
Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
G & L and Hypro Div., Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., Woodburn Ave. and Penn R.R., Evanston, Cincinnati, Ohio
Hamilton Div., Baldwin-Lima-Hamilton Corp., Hamilton, Ohio
Ingersoll Milling Machine Co., 505 Fulton Ave., Rockford, Ill.
Kearney & Trecker, Corp., 6784 W. National, Milwaukee 14, Wis.
Orban, Kurt Co., Inc., 42 Exrhange Place, Jersey City, N. J.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Spar

Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
G & L and Hypro Div., Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Hamilton Div., Baldwin-Lima-Hamilton Corp., Hamilton, Ohio
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MOLDING MACHINES, Plastic

Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinati 29, Ohio
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio

MOTORS, Air

Ingersoll-Rand Co., Phillipsburg, N. J.

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"H.B.M., Model 75 is better than any other machine we've ever seen."

This statement by Mr. John Gruber, Plant Foreman of George Hantscho and Company, Inc., Mount Vernon, New York, manufacturers of printing equipment, sums up their experience since installing the Bullard 4" H.B.M., Model 75, in June 1957.

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"The only mass production we have is the machining of holes in cast iron, up to as many as 105 in a side frame. Since we've been using our Bullard H.B.M., Model 75, with BULLARD AUTOMATIC POSITIONING we have not spoiled a single piece due to the malfunctioning of the machine."

Do you know the full story on the Bullard H.B.M., Model 75? If not, it will pay you to call your nearest Bullard Sales Engineer — he'll be glad to give you all the details or write

THE BULLARD COMPANY BRIDGEPORT 9, CONN.

MOTORS, Electric
Lincoln Electric Co., Cleveland 17, Ohio

MOTORS, Hydraulic
Barnes, John S. Corp., Rockford, Ill.
Denison Engineering, Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hydraulic Press Mfg. Div., Mt. Gilead, Ohio
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Vickers, Inc., Detroit 32, Mich.

MULTIPLE INSPECTION GAGES—See Gages, Multiple Inspection

MULTIPLE-STATION MACHINES, Dial Type
Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Baush Mch. Tool Co., 15 Wason Ave., Springfield, Mass.
Bodine Corp., 317 Mt. Grove St., Bridgeport 5, Conn.
Buhr Machine Tool Co., 839 Greene St., Ann Arbor, Mich.
Cross Co., P. O. Box 3835, Park Grove Postal Sta., Detroit 5, Mich.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Greenlee Bros. & Co., 2136 12th St., Rockford, Ill.
Kingsbury Mch. Tool Corp., Keene, N. H.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
National Automatic Tool Co., S. 7th N. St., Richmond, Ind.
Snyder Corp., 3400 E. Lafayette Ave., Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 - 11th St., Rockford, Ill.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.

MULTIPLE-STATION MACHINES, Transfer Type
Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Baush Mch. Tool Co., 15 Wason Ave., Springfield, Mass.
Buhr Mch. Tool Co., 839 Green St., Ann Arbor, Mich.
Bullard Co., Bridgeport 6, Conn.
Cincinnati Milling Mch. Co., Cincinnati 9, Ohio
Clearing Div., of U. S. Industries, Inc., 6499 W. 65th St., Chicago 38, Ill.
Cross Co., P. O. Box 3835, Park Grove Postal Sta., Detroit 5, Mich.
Davis & Thompson Co., 4460 N. 124th St., Milwaukee 10, Wis.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Greenlee Bros. & Co., 2136 - 12th St., Rockford, Ill.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
La Maire Machine Tool Co., 2657 S. Telegraph Road, Dearborn, Mich.
Moline Tool Co., 102-20th St., Moline, Ill.
National Automatic Tool Co., S. 7th N. Sts., Richmond, Ind.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Snyder Corp., 3400 E. Lafayette Ave., Detroit 7, Mich.
Sundstrand Mch., Tool Co., 2531 11th St., Rockford, Ill.
Ave., Chicago 19, Ill.
Waterbury Farrel Foundry & Mach. Co., Waterbury, Conn.

NIBBLERS, Portable Pneumatic
Buckeye Tools Corp., Dayton, Ohio

NIBBLING MACHINES
Wales-Strippit, Inc., Akron, N. Y.

NUT SETTERS—See Screwdrivers, etc.

NUTS—See Bolts, Nuts and Screws

OIL GROOVERS
Wicaco Machine Corp., Wayne Junction, Philadelphia, Pa.

OILERS AND LUBRICATORS
Gits Bros. Mfg. Co., 1858 S. Kilburn Ave., Chicago, Ill.
Madison-Kipp Corp., Madison, Wis.
Wicaco Mch. Corp., Philadelphia, Pa.

OILS, CUTTING SOLUBLE—See Cutting and Grinding Fluids

OILS, Lubricating—See Lubricating Oils and Greases

OILS, Quenching and Tempering
Cities Service Oil Co., 70 Pine St., New York, N. Y.
Houghton, E. F. & Co., 303 W. Lehigh Ave., Philadelphia 33, Penna.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Sinclair Refining Co., 600 - 5th Ave., New York, N. Y.
Standard Oil Co. (Indiana), 910 S. Michigan Ave., Chicago 80, Ill.

OPTICAL FLATS
Crane Packing Co., 6400 Oakton St., Morton Grove, Ill.
DoALL Co., Des Plaines, Ill.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Van Keuren Co., 176 Waltham St., Watertown 72, Mass.

PACKING, Leather, Metal, Rubber Asbestos, Etc.
Crane Packing Co., 6400 Oakton St., Morton Grove, Ill.
Houghton, E. F. & Co., 303 W. Lehigh Ave., Philadelphia 33, Penna.

PAINTING EQUIPMENT, Spray—See Spraying Equipment, Metal

PARALLELS
Brown & Sharpe Mfg. Co., Providence, R. I.
DoALL Co., De Plaines, Ill.
Starrett, The L. S., Co., Athol, Mass.
Walker, O. S., Co., Inc., Worcester, Mass.

PATTERNS, Wood and Metal
Mummert-Dixon Co., Hanover, Pa.

PILLOW BLOCKS
S K F Industries, Inc., Philadelphia, Penna.

PIPE, Steel, Stainless, etc.
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., 105 W. Bern St., Reading, Penna.
Ryerson, Joseph T. & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.
United States Steel Corp., National Tube Co., Div., 436 7th Ave., Pittsburgh, Pa.

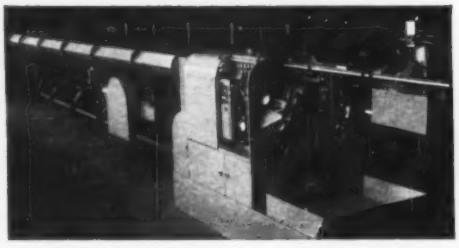
PIPE AND TUBING MILLS, Electric-weld
Yoder Co., 5504 Walworth Ave., Cleveland 2, Ohio

PIPE AND TUBING, Brass and Copper
American Brass Co., 25 Broadway, New York, N. Y.
Mueller Brass Co., 1925 Lapeer Ave., Port Huron, Mich.
Revere Copper & Brass Inc., 230 Park Ave., New York 17, N. Y.

FASTER AUTOMATIC CUT-OFF
Tubing, Pipe and Bar Stock

The Modern Way

Automatic operation—from loading to final cut-off. Handles solid bar stock up to 3" O.D.—tubing up to 8" O.D. Cuts any material that can be turned. 16 spindle speeds.



107

The Modern Automatic Cutting-Off Machine and Bar Feeder Combination, shown above, handles random lengths of tubing, pipe and bar stock. With this combination the entire load is fed to the cutting-off machine without attention of an operator. Feeders are available for any maximum length bars. Only one single crank adjustment needed—for stock diameter.

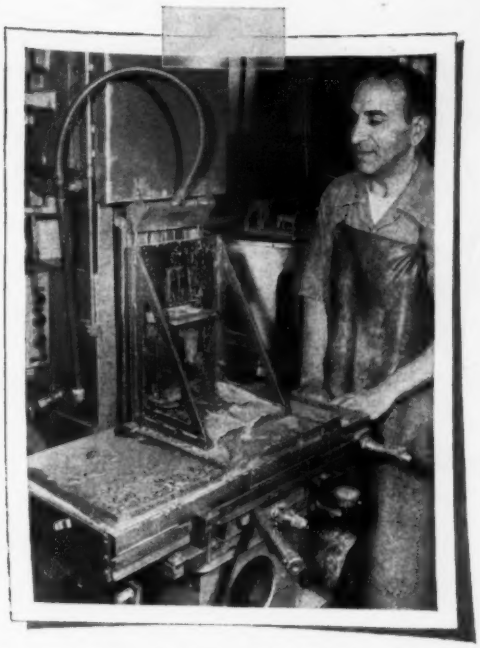
WRITE FOR CATALOG

Has complete specifications of all models. Illustrates parts that are being formed, grooved, flanged or chamfered and cut off in a single operation at a high rate of speed. Also describes the automatic feeder, hot spinning machine for sealing ends of tubing, and the Modern Safety Drill Table.

MODERN MACHINE TOOL CO.
2005 LOSEY AVENUE
Jackson, Michigan

A 3M Case History Report

GRINDING PRODUCTION INCREASED 50% WITH "WETORDRY" BELTS



MANUFACTURER: Dictaphone Corporation

ADDRESS: Bridgeport, Conn.

PRODUCTS MANUFACTURED: Dictating Equipment

3M ABRASIVE USED: "WETORDRY" Tri-M-ite Cloth Belts

HOW 3M ABRASIVES ARE USED: Sizing bottom side of cast magnesium main frame of Dictaphone dictating machine, to remove burrs and casting imperfections for true flatness.

OPERATIONAL DATA ON 3M METHOD: Grit 60 "Wetordry Tri-M-ite" Cloth Belt is used on an Engleberg Huller BG8 Grinder. Constant flow of water is maintained over grind surface of the magnesium.

OPERATIONAL DATA ON PREVIOUS METHOD: A competitive brand of abrasive belt was used for the same operation.

PROVEN ADVANTAGES OF 3M METHOD: Production increased 50% per belt—from 900 pieces with the former belt to 1,350 pieces per 3M Belt with no loss in time or decrease in quality.

OTHER 3M ABRASIVE PRODUCTS NOW IN USE: "Three-M-ite Resinite" Cloth Belts are used to finish aluminum trim bands; "Tri-M-ite" Cloth "PG" Wheel used to pre-polish dictating belt mandrel ends.

WANT MORE INFORMATION? Send for free manual, "3M Method of Belt Grinding and Finishing." Just write on your letterhead to 3M Co., St. Paul 6, Minn., Dept. TV-59.

"Wetordry", "Tri-M-ite", "Resinite", and "Three-M-ite" are registered trademarks of 3M Co., St. Paul 6, Minn.
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How to use coated abrasives to cut costs ... improve production, shown in the new 426 page book
COATED ABRASIVES
MODERN TOOL OF INDUSTRY
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3M Coated Abrasives
"WETORDRY" CLOTH BELTS

MINNESOTA MINING AND MANUFACTURING COMPANY
...WHERE RESEARCH IS THE KEY TO TOMORROW

3M COMPANY

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Landis Machine Co., Inc., Waynesboro, Pa.
Sheffield Corp., Box 893, Dayton 1, Ohio

PLANER JACKS—See Set-up Equipment

PLANERS, Double Housing and Openside

Berthiez, Charles, 5 Rue Montalivet, Paris, France
Consolidated Mch. Tool Div., Rochester, N. Y.
Gray, G. A. Co., 3611 Woodburn Ave., Cincinnati, Ohio
Hamilton Div., Baldwin-Lima-Hamilton Corp., Hamilton, Ohio
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.

PLASTICS AND PLASTIC PRODUCTS

Eastman Kodak Co., 343 State St., Rochester 4, N. Y.
Gisholt Mch. Co., Madison, Wis.
U. S. Steel Corp., Nat'l Tube Div., Pittsburgh, Pa.

PRESS BRAKES—See Brakes, Press and Bending

PRESS FEEDER, Automatic

Bliss, E. W. Co., 1375 Raff Rd., S.W., Canton, Ohio
Federal Press Co., 511 Division St., Elkhart, Ind.
Producto Machine Co., 985 Housatonic Ave., Bridgeport 1, Conn.
U. S. Tool Co., 255 N. 18th St., Ampere, East Orange, N. J.

PRESSES, Arbor

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Logansport Machine Co., Inc. Logansport, Ind.
Threadwell Tap & Die Corp., 16 Arch St., Greenfield, Mass.

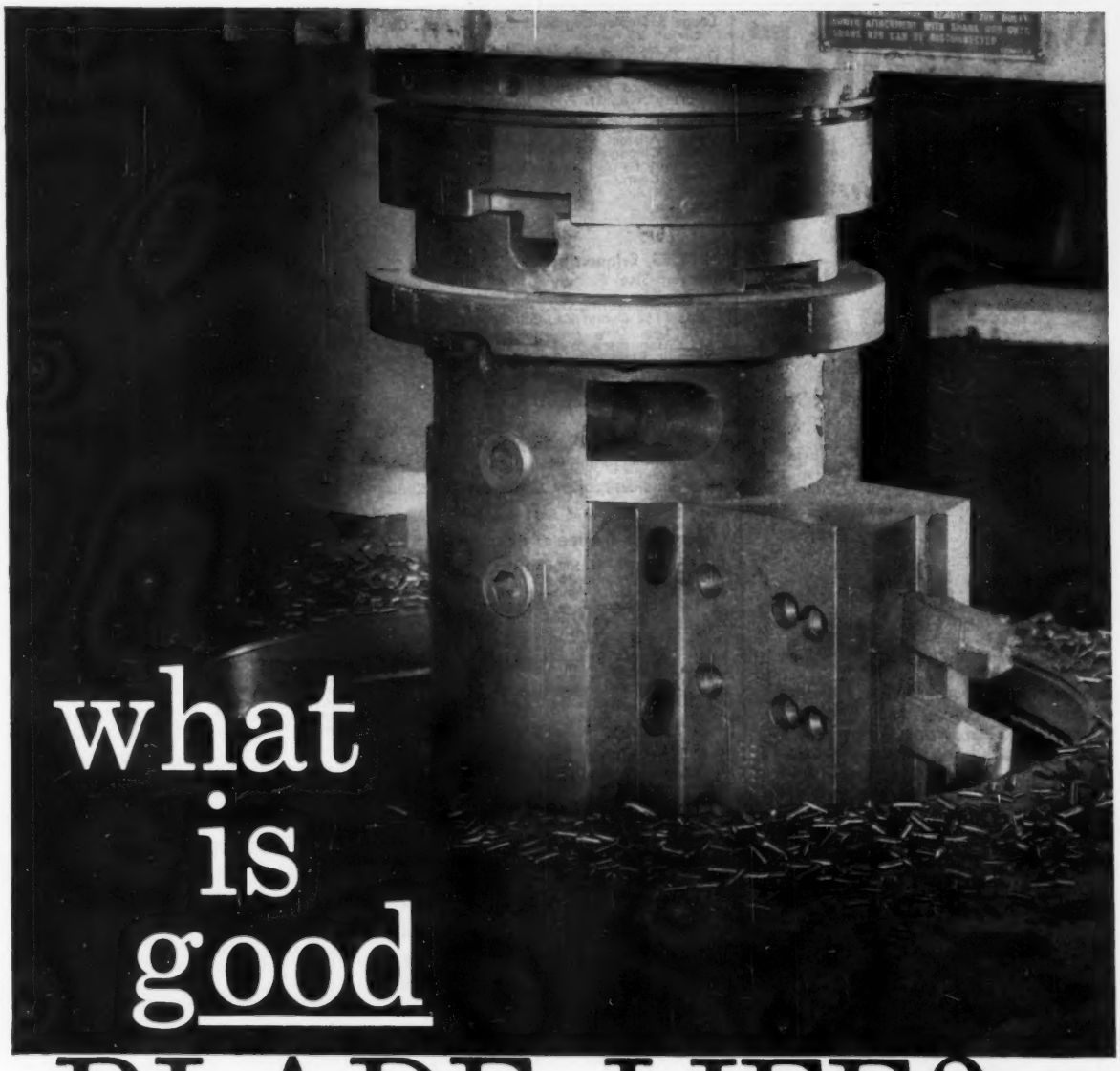
PRESSES, Assembling

Allen, Alva Industries, Clinton, Missouri
Bliss, E. W. Co., 1375 Raff Rd., S.W., Canton, Ohio
Denison Engineering Div., American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Federal Press Co., 511 Division St., Elkhart, Ind.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Northern Hydraulics & Mach. Corp., Melrose Park, Ill.

PRESSES, Blanking, Stamping

Allen, Alva Industries, Clinton, Missouri
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S.W., Canton, Ohio
Chambersburg Engineering Co., Chambersburg, Pa.
Clearing Div., of U. S. Industries, Inc., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Crane & Engineering Co., Wickliffe, Ohio
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Danly Machine Specialties, Inc., 2100 South Laramie, Chicago 50, Ill.
Denison Engineering, Div. American Brake Shoe Co., 152 Dublin Rd., Columbus 16, Ohio
Federal Press Co., 511 Division St., Elkhart, Ind.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
L & J Press Corp., 1631 Sterling Ave., Elkhart, Ind.

(Continued on page 276)



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The point is, every job has a different set of variables that affect performance characteristics and costs. And an essential part of our product is a study of these variables to help you develop the lowest cutter costs consistent with improved performance. We consider your machine, work piece, feed rate, depth of cut, speed and finish requirements. Only after this information is pooled with your own knowledge of the application—costs and performance of present equipment—is any cutter or grinding technique recommended.

We would welcome the opportunity to tell you more about this unique cutter selection service. Write:

This helpful new booklet tells you how to reduce the cost of chips and improve your milling and boring performance. Ask for a free copy of booklet No 68B.

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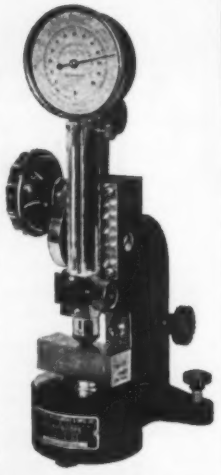
HARDNESS TESTING

Shore's Improved Direct Reading Scleroscope (above) and Standard Recording Scleroscope (below) with dial graduated in standard Scleroscope and equivalent Brinell and Rockwell "C" Hardness Numbers, are able to perform over 1000 hardness tests per hour. Both Scleroscopes are completely portable, operative on all types and sizes of metals, are reliable in hands of non-technical help, and show no visible injury signs on finished surfaces. Write for free brochures on these instruments.



Direct Reading Scleroscope shown above with special Swing Arm & Post Assembly. Height capacity 9", reach 14". To be mounted on bench for testing large objects. Supplied with two test blocks and diamond hammer.

Standard Recording Scleroscope (right) with Clamping Stand, jaw capacity 3" high x 2⅛" deep. Supplied with following accessories: diamond hammer, hard and soft test block, V block for testing rounds, and steel carrying case.

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Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Sales Service Manufacturing Co., 2363 University Ave., St. Paul, Minn.
U. S. Tool Co., Inc., 255 N. 8th St., Ampere, East Orange, N. J.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Waterbury Farrel Foundry & Mach. Co., Waterbury, Conn.

PRESSES, Briquetting

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Denison Engineering Div., American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Hydraulic Press Mfg. Co., Mount Gilead, Ohio

PRESSES, Closed-Die Forging

Ajax Manufacturing Co., 1441 Chardon Rd., Cleveland 17, Ohio
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S.W., Canton, Ohio
Chambersburg Engineering Co., Chambersburg, Pa.
Clearing Div., of U. S. Industries, Inc., 6499 W. 65th St., Chicago 38, Ill.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.

PRESSES, Coining, Embossing

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S.W., Canton, Ohio
Chambersburg Engineering Co., Chambersburg, Pa.
Clearing Div., of U. S. Industries, Inc., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Danly Machine Specialties, Inc., 2100 South Laramie, Chicago 50, Ill.
Denison Engineering, Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Waterbury Farrel Foundry & Mach. Co., Waterbury, Conn.

PRESSES, Die Sinking (Hobbing)

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S.W., Canton, Ohio
Chambersburg Engineering Co., Chambersburg, Pa.
Clearing Div., of U. S. industries, Inc., 6499 W. 65th St., Chicago 38, Ill.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Waterbury Farrel Foundry & Mach. Co., Waterbury, Conn.

PRESSES, Die Tryout

Bliss, E. W. Co., 1375 Raff Rd., S.W., Canton, Ohio
Clearing Div., of U. S. Industries, Inc., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Elmes Eng Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Federal Press Co., 511 Division St., Elkhart, Ind.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
L & J Press Corp., 1631 Sterling Ave., Elkhart, Ind.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Producto Machine Co., 985 Housatonic Ave., Bridgeport 1, Conn.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.

PRESSES, Drawing

Allen, Alva Industries, Clinton, Missouri
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S.W., Canton, Ohio
Cincinnati Milling & Grinding Machines, Inc., 4710 Marburg Ave., Cincinnati 9, Ohio
Clearing Div., of U. S. Industries, Inc., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Crane & Engineering Co., Wickliffe, Ohio
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Danly Machine Specialties, Inc., 2100 South Laramie, Chicago 50, Ill.
Denison Engineering, Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
L & J Press Corp., 1631 Sterling Ave., Elkhart, Ind.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Waterbury Farrel Foundry & Mach. Co., Waterbury, Conn.

PRESSES, Extrusion

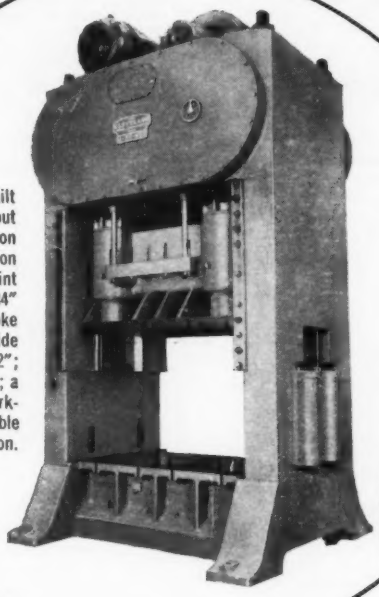
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S.W., Canton, Ohio
Clearing Div., of U. S. Industries, Inc., 6499 W. 65th St., Chicago 38, Ill.
Danly Machine Specialties, Inc., 2100 South Laramie, Chicago 50, Ill.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.

PRESSES, Foot

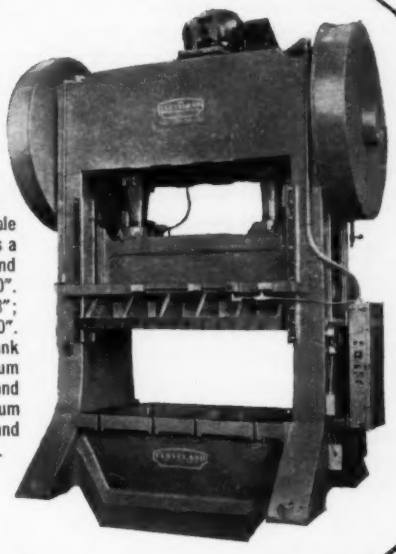
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Producto Machine Co., 985 Housatonic Ave., Bridgeport 1, Conn.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Waterbury Farrel Foundry & Mach. Co., Waterbury, Conn.

PRESSES, Horning

Bliss, E. W. Co., 1375 Raff Rd., S.W., Canton, Ohio
Clearing Div., of U. S. Industries, Inc., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.



Ruggedly built for day-in, day-out steady production —this 400-ton Cleveland 4-point Press has a 60 x 84" bed area; stroke of slide, 18"; slide adjustment, 12"; shut height, 54"; a dependable work-horse for profitable production.



This 300-ton Straight-Sided Double Crank Press has a 60 x 84" bed area and shut height of 40". Stroke of slide, 18"; Slide adjustment, 10". This double crank press offers maximum accuracy and die life—minimum maintenance and per-part cost.

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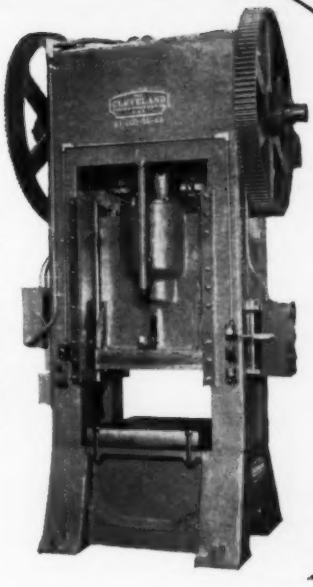

This Cleveland 200-ton Straight Sided Single Crank Press is ruggedly built to meet your trimming, blanking, drawing and other press needs. Bed area, 42 x 36"; stroke of slide, 12"; slide adjustment, 6"; shut height, 26".

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Allen, Alva Industries, Clinton, Missouri
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Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wales-Strippit, Inc., Akron, N. Y.

PRESSES, Punching, Piercing
Allen, Alva Industries, Clinton, Missouri
Beatty Machine & Mfg. Co., Hammond, Ind.
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S.W., Canton, Ohio
Clearing Div., of U. S. Industries, Inc., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Crane & Engineering Co., Wickliffe, Ohio
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Danly Machine Specialties, Inc., 2100 South Laramie, Chicago 50, Ill.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Federal Press Co., 511 Division St., Elkhart, Ind.
L & J Press Corp., 1631 Sterling Ave., Elkhart, Ind.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wales-Strippit, Inc., Akron, N. Y.
Waterbury Farrel Foundry & Mach. Co., Waterbury, Conn.

PRESSES, Quenching
Gleason Wks., 1000 University Ave., Rochester 3, N. Y.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio

PRESSES, Rubber-Forming
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S.W., Canton, Ohio
Chambersburg Engineering Co., Chambersburg, Pa.
Cincinnati Milling & Grinding Machines, Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Clearing Div., of U. S. Industries, Inc., 6499 W. 65th St., Chicago 38, Ill.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Verson Allsteel Press Co., 9303 S. Kenwood Ave., Chicago 19, Ill.

PRESSES, Trimming
Allen, Alva Industries, Clinton, Missouri
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S.W., Canton, Ohio
Chambersburg Engineering Co., Chambersburg, Pa.
Clearing Div., of U. S. Industries, Inc., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Punch & Shear Wks., Co., 3917 St. Clair Ave., Clevelana 14, Ohio
Danly Machine Specialties, Inc., 2100 South Laramie, Chicago 50, Ill.
Denison Engineering, Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., 1253 W. 12th St, Erie, Penna.
Federal Press Co., 511 Division St., Elkhart, Ind.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
L & J Press Corp., 1631 Sterling Ave., Elkhart, Ind.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.

PROFILING MACHINES—See Milling Machines, Die Sinking, etc.

PULLEYS
Brown & Sharpe Mfg. Co., Providence, R. I.
DoALL Co., Des Plaines, Ill.

PUMPS, Coolant and Lubricant
Barnes, John S., Corp., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoALL Co., Des Plaines, Ill.
Ingersoll-Rand Co., Phillipsburg, N. J.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Ruthman Machinery Co., 1809 Reading Rd., Cincinnati, 2, Ohio

PUMPS, Hydraulic
Barnes, John S., Corp., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Denison Engineering, Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Hydraulic Press Mfg. Div., Mount Gilead, Ohio
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Vickers Incorporated, Division of Sperry Rand Corp., 1402 Oakman Blvd., Detroit, Mich.

PUNCHES AND DIES—See Dies, Blanking, etc.

REAMERS, Rose, Chucking, Jobbers Taper, Shell, Adjustable, etc.
Barber-Colman Co., 1300 Rock St., Rockford, Ill.
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., 1242 49th St., Cleveland, Ohio
Cogsdill Twist Drill Co., Greenfield, Mass.
DoALL Co., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
Jarvis Corp., Stack Ave., Middletown, Conn.
Tomkins-Johnson Co., 617 N. Mechanic St., Jackson, Mich.

REELS, Stock
National Acme Co., 170 E. 131st St., Cleveland 3, Ohio
U. S. Tool Co., Inc., 255 North 18th St., Ampere, E. Orange, N. J.

REFRACTORS Heat-Treating Furnaces
Norton Co., 1 New Bond St., Worcester 6, Mass.

RETAINING RINGS
Waldes Kohinoor, Inc., 47-16 Austel Pl., Long Island City 1, N. Y.

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Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.

RIVETERS, Stationary
Brown & Sharpe Mfg. Co., 35 Promenade St., Providence 1, R. I.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Tompkins-Johnson Co., 617 N. Mechanic St., Jackson, Mich.

ROTARY TABLES, Optical
Machine Products Corp., 6771 E. McNichols Rd., Detroit 12, Michigan

RULES, SCALES AND STRAIGHTEDGES See Machinists' Small Tools

RUST INHIBITORS
Houghton, E. F. & Co., 303 W. Lehigh Ave., Philadelphia 33, Penna.
Oakite Products, Inc., 26 Rector St., New York, N. Y.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Shell Oil Co., 50 W. 50th St., New York, N. Y.

SAND BLAST EQUIPMENT—See Blast Cleaning Equipment

SAW BLADES, Hack, Band, Circular Friction
Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Capewell Mfg. Co., 60 Governor St., Hartford, Conn.
Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.
DoALL Co., Des Paines, Ill.
Espen-Lucas Mach Works, Philadelphia, Pa.
Motch & Merryweather Mchy. Co., 888 E. 70th St., Cleveland 3, Ohio
Starrett, The L. S., Co., Athol, Mass.

SAW BLADE SHARPENERS
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Motch & Merryweather Mchy. Co., 888 E. 70th St., Cleveland 3, Ohio

SAWING MACHINES, Abrasive Machines—See Cutting-off Saws, Abrasive Wheel

SAWING MACHINES, Band
Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
DoALL Co., Des Plaines, Ill.

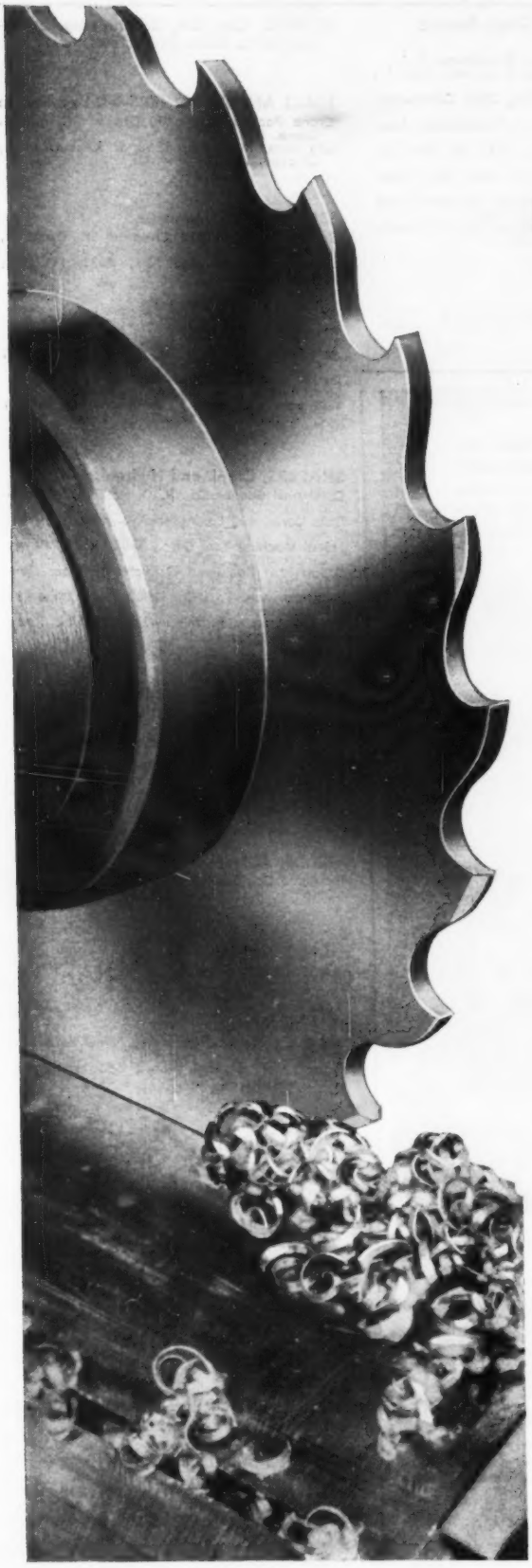
SAWING MACHINES, Circular Blade
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Motch & Merryweather Mchy. Co., 888 E. 70th St., Cleveland 3, Ohio
Ty-Sa-Man Machine Co., Inc., 1093 White Ave., Knoxville, Tenn.

SAWING MACHINES, Power Hack
Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York 17, N. Y.

SAWS, Screw-slotting—See Cutters, Milling

SCREW DRIVERS, STUD AND NUT SETTERS, Power
Bodine Corp., 317 Mt. Grove St., Bridgeport 5, Conn.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Cleco Air Tools, P. O. Box 2119, Houston, Texas
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.

(Continued on page 280)



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Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

SCREW MACHINES, Hand—See Lathes, Turret, Ram-type, Saddle-type

SCREW MACHINES, Multiple-Spindle Automatic

Greenlee Bros. & Co., 2136 12th St., Rockford, Ill.
National Acme Co., 170 E. 31st St., Cleveland, Ohio
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Warner & Swasey Co., 6701 Carnegie Ave., Cleveland 3, Ohio

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Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gear Grinding Machine Co., 3901 Christopher St., Detroit 11, Mich.
Gisholt Mch. Co., 1245 E. Washington Ave., Madison 10, Wis.
Gorton, George Mch. Co., 1110 W. 13th St., Racine, Wis.
National Acme Co., 170 E. 131st St., Cleveland, Ohio
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.

SCREW PLATES

Greenfield Tap & Die Corp., Greenfield, Mass.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.

SCREWS, Cap, Set, Self-tapping, etc.—See Bolts, Nuts and Screws

SEALS AND RETAINERS—Oil or Grease

Crane Packing Co., 6400 Oakton St., Morton Grove, Ill.
Gits Bros. Mfg. Co., 1858 S. Kilbourn Ave., Chicago, Illinois

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SET-UP EQUIPMENT

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Lufkin Rule Co., Saginaw, Mich.
Starrett, The L. S., Co., Athol, Mass.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

SHAPERS, Crank and Hydraulic

Cincinnati Shaper Co., P. O. Box 111, Cincinnati 11, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Nebel Machine Tool Corp., 3401 Central Pkwy, Cincinnati 25, Ohio
Orban Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.

SHAPERS, Vertical and Slotters

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Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Orban, Kurt Co., 42 Exchange Place, Jersey City 2, N. J.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.

SHEARS, Alligator

Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio

SHEARS, Guillotine Bar

Beatty Machine & Mfg. Co., Hammond, Ind.

SHEARS, Rotary

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.

SHEARS, Squaring

Birdsboro Steel Fdy. & Mch. Co., Birdsboro, Pa.
Cincinnati Shaper Co., P. O. Box 111, Cincinnati 11, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.

SHEET METALS—See Strip and Sheet, Ferrous, Non-ferrous

SHIM STOCK

Laminated Shim Co., Inc., Glenbrook, Conn.

SLITTING MACHINES, Rotary

Bliss Co., E. W., Canton, Ohio
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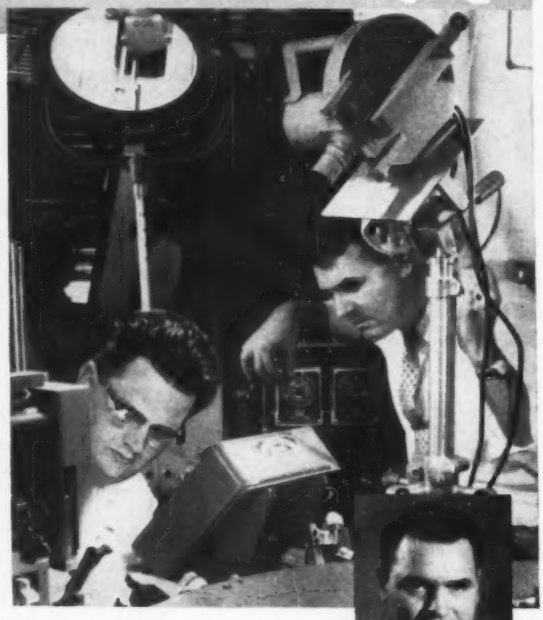

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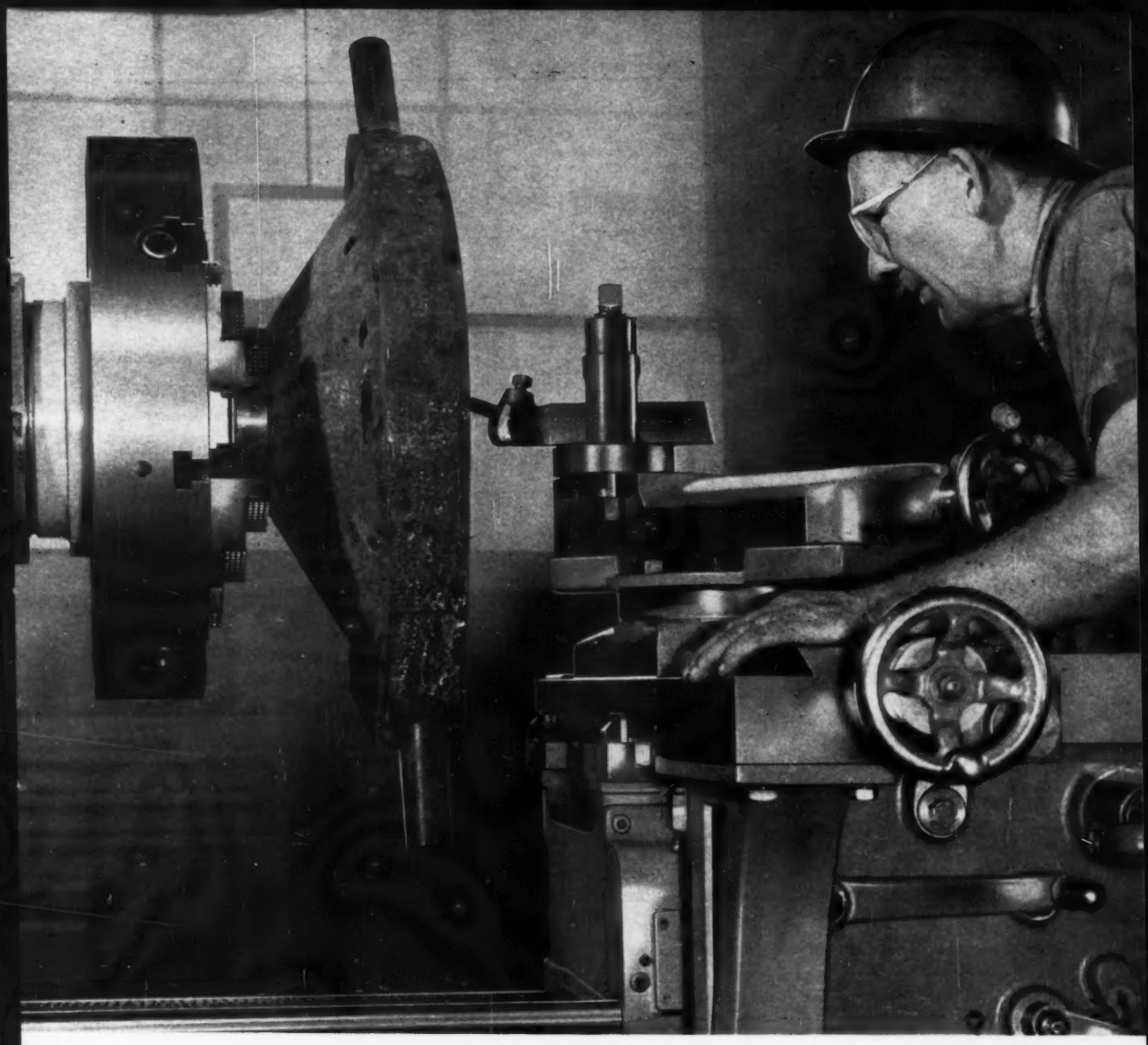

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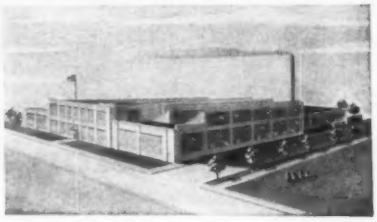

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SOCKETS—See Drill Sleeves and Extension Holders

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Barnes, W. F. & John Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Bethlehem Steel Co., Bethlehem, Pa.
Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Blanchard Mch. Co., 64 State St., Cambridge, Mass.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Burg Tool and Mfg. Co., Inc., 15001 S. Figueroa, Gardena, Calif.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Columbus Die-Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Erie Foundry Co., Erie, Pa.
Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Hydraulic Press Mfg. Co., Mt. Gilead, Ohio.
Ingersoll Milling Machine Co., 505 Fulton Ave., Rockford, Ill.
Kingsbury Mch. Tool Corp., Keen, N. H.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Le Maire Machine Tool Co., 2657 S. Telegraph Rd., Dearborn, Mich.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Modern Industrial Engrg. Co., 14230 Birwood, Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Motch & Merryweather Mchy. Co., 888 E. 70th St., Cleveland 3, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
National Twist Drill & Tool Co., Rochester, Mich.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Sheffield Corp., Box 893, Dayton 1, Ohio
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
Sundstrand Mch. & Tool Co., 2531 11th St., Rockford, Ill.
Universal Engrg. Co., Frankenmuth 2, Mich.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.
Wicaco Machine Corp., Wayne Junction, Philadelphia, Pa.

SPEED REDUCERS
Barnes, John S. Corp., Rockford, Ill.
Boston Gear Works, 320 Main St., North Quincy 71, Mass.
Horsburgh & Scott Co., 5114 Hamilton, Cleveland, Ohio.
James, D. O., Gear Mfg. Co., 1140 W. Monroe St., Chicago 7, Ill.

"TOUGH NUTS?...We Put Ours on NATIONAL Cold Nut Formers!"

These Unusual Nuts Are Being Made from Various Materials (Including High-Carbon) on National Cold Nut Formers.

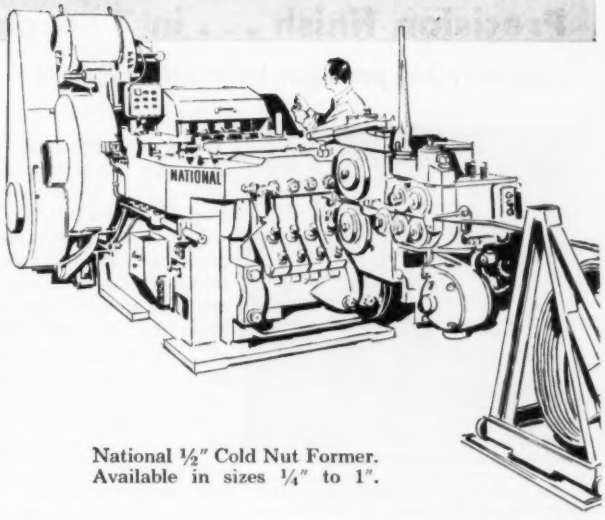
The slogan, "We Put Our Tough Ones on Nationals," is not one we dreamed up.

It sprang up in the trade, among the highly-skilled and well-equipped Nut manufacturers who have been meeting competently your "impossible" demands and your normal needs.

Have you looked into the design variations and high quality attainable these days by users of National Cold Nut Formers? If you make Nuts, or other cold-formed parts (or parts which should be cold-formed) have you considered widening your range and type of work? By offering the most modern, productive and profitable Cold Nut Formers available, we can help you meet quickly the growing demands of metalworking.

Tool design? Our working development engineers — contributing daily to the science of Metal Flow — are at your service.

Let us work with you.



National ½" Cold Nut Former. Available in sizes ¼" to 1".

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NATIONAL MACHINERY CO.

TIFFIN, OHIO, U. S. A.

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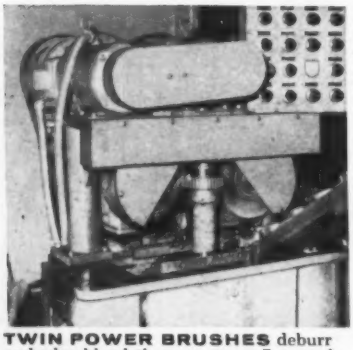
BEFORE BRUSHING — Automotive clutch component . . . with sharp edges plus fine machining chips and burrs still carried inside teeth.

AFTER BRUSHING—Edges and surface junctures are uniformly precision blended. Chips and burrs are thoroughly removed to help assure troublefree operation of the installed part.

Precision finish . . . in 7 seconds flat

. . . capacity 360 parts-per-hour with OSBORN Power Brushing



TWIN POWER BRUSHES deburr and edge-blend these parts on 7-second cycles. Osborn 6" Monitor® Brushes—operating at 1750 rpm—do the job at high production rates. Quality is excellent . . . cost is low.

IF you precision finish parts, and want to do the job faster . . . with improved quality . . . at less cost—today's Osborn Power Brushing methods can help you do it.

For example—this leading automotive parts manufacturer uses a dual-brush setup to automatically deburr and edge-blend precision clutch parts. In addition to the *versatility* and *precise quality control* he's afforded by Osborn Power Brushing—he finds finishing operations are done faster and at significantly lower cost.

It's typical of how *you* can pinpoint savings, too. An **O**sborn **B**rushing **A**nalysis—made in your plant at no cost or obligation—is the first step. Write us for full details. *The Osborn Manufacturing Company, Dept. D-52, Cleveland 14, Ohio.*

Osborn Brushes

BRUSHING MACHINES • BRUSHING METHODS
POWER, PAINT AND MAINTENANCE BRUSHES • FOUNDRY PRODUCTION MACHINERY

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SPINDLES, Machine
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
National Automatic Tool Co., S. 7th and N Sts., Richmond, Ind.
Standard Electrical Tool Co., 2488-90 River Road, Cincinnati, Ohio.

SPRAYING EQUIPMENT, Metal
Metallizing Eng. Co., Westbury, L. I., N. Y.

SPROCKETS—See Gears, Cut

STAMPINGS, Sheet Metal
Laminated Shim Co., Inc., Glenbrook, Conn.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

STEEL ALLOYS—See Alloy Steels

STEEL, Cold Rolled, Stainless, High-speed, Tool, etc.
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., 105 W. Bern St., Reading, Penna.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.
Timken Roller Bearing Co., Canton, Ohio.
Vanadium-Alloys Steel Co., Latrobe, Penna.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

STEEL DISTRIBUTORS
Ryerson, Jos. T., & Son, 16th & Rockwell Sts., Chicago 8, Ill.

STOCKS AND DIES
DoALL Co., Des Plaines, Ill.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Landis Mch. Co., Waynesboro, Pa.
Threadwell Tap & Die Co., Greenfield, Mass.

STRAIGHTEDGES—See Machinists' Small Tools

STRAIGHTENERS, Flat Stock and Wire
Bliss Co., E. W., Canton, Ohio.
Niagara Mch. & Tool Wks., 637-697 Northland Ave., Buffalo 11, N. Y.
U. E. Tool Co., Inc., 255 North 18th St., Ampere, E. Orange, N. J.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Waterbury Farrel Foundry & Mach. Co., Waterbury, Conn.

STRIP AND SHEET, Ferrous
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., 105 W. Bern St., Reading, Penna.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.

STRIP AND SHEET, Non-ferrous
American Brass Co., 25 Broadway, New York, N. Y.
Bethlehem Steel Co., Bethlehem, Pa.
Bridgeport Brass Co., Bridgeport, Conn.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.

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USS Shelby Seamless Mechanical Tubing

USS Shelby Seamless Steel Mechanical Tubing offers you extraordinary freedom of design in a wide range of products from bushings to hydraulically operated telescoping booms. And, Shelby Seamless Tubing helps cut processing costs, because it eliminates drilling operations; enables you to replace drills with simple, less expensive boring tools, and it reduces tool wear and tool changes; and, more important, more uniform parts can be turned out by the hundreds or thousands.

Where Shelby Seamless Tubing is used as a load-carrying member or part, it exhibits a number of structural advantages over other forms. *Here are a few:* it gives you a superior cross section when a part is designed to withstand equal loading in any direction; it resists bending stresses equally in all directions; it is able to absorb and localize shock; and in torsion, it provides better material distribution, and for a given weight, can withstand more load than other sections.

And, of course, the name Shelby is backed by the world's largest and most experienced manufacturer of seamless tubing—National Tube! The production of Shelby Seamless Tubing, from ore to finished product, is entirely controlled by one organization. There is no divided responsibility. Every foot, every length, is made under the careful supervision of skilled men with years of tubemaking experience. For more than 60 years, Shelby Seamless Tubing has been first with men who want the best in mechanical tubing.

You'll find Shelby Seamless Tubing available at select Shelby Distributors throughout the country. These distributors are strategically located and expertly trained in solving all types of tubing problems. Here, you can choose from a complete range of sizes and stocks. If you'd like to find out how Shelby Seamless Tubing can be most effectively applied to your designs, contact your nearest Shelby Distributor . . . *soon!*

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United States Steel

Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors
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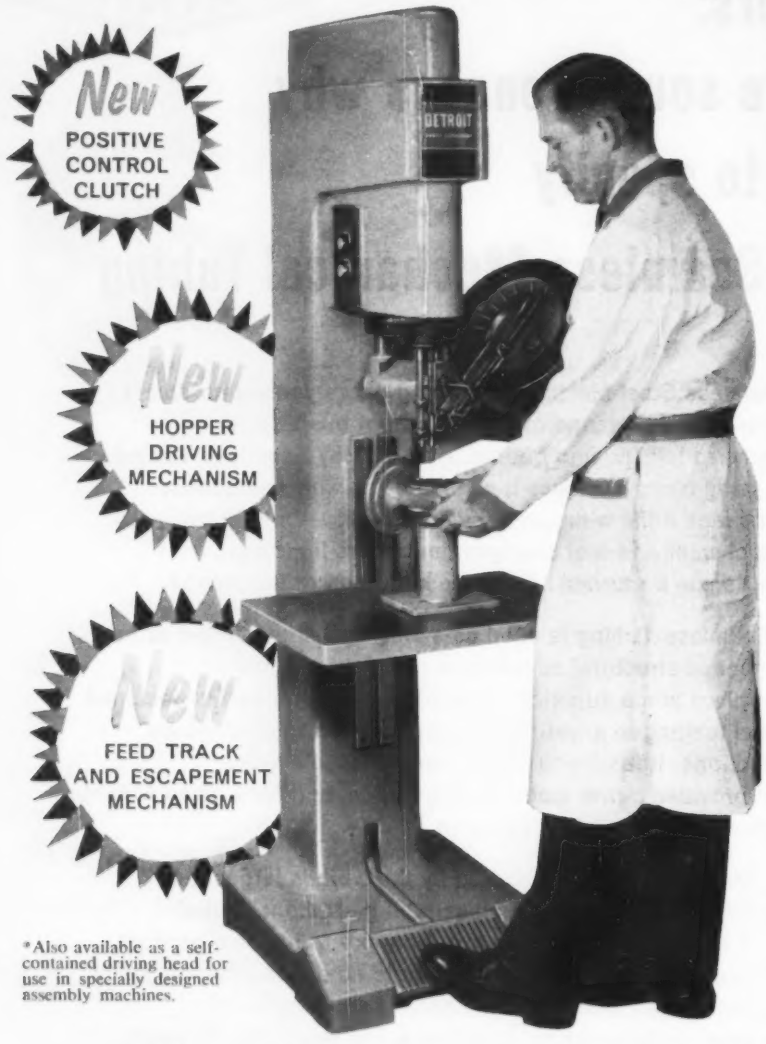

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Manufacturing assemblies with small parts? Take note! Detroit Power Screwdriver Company announces the totally new Model U—quickly adaptable for fast, clean driving of screws, nuts and studs.

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Bethlehem Steel Co., Bethlehem, Pa.
Revere Copper & Brass, Inc., 230 Park Ave., New York 17, N. Y.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.

STUD SETTERS—See Screwdrivers, etc.

SUPERFINISHING EQUIPMENT
Gishold Machine Co., 1245 E. Washington Ave., Madison 10, Wis.

SURFACE PLATES
Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
DoALL Co., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.

SWITCHES, Limit
Allen-Bradley Co., 1331 So. 1st St., Milwaukee, Wis.

TACHOMETERS—See Indicators, Speed

TAP HOLDERS
Brown & Sharpe Mfg. Co., 235 Promenade St. Providence 1, R. I.
Burgmaster Corp., 15001 S. Figeroa, Gardena, Calif.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
National Automatic Tool Co., S. 7th and N Sts., Richmond, Ind.

TAPPING HEADS
Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
Davis Boring Tool Div., Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Jarvis Corp., Stack Ave., Middletown, Conn.
Kato Mfg. Co., Osaka, Japan.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Leland-Gifford Co., 1425 Southbridge St., Worcester, Mass.
National Automatic Tool Co., S. 7th & N Sts., Richmond, Ind.
Thriftmaster Products Corp., 1076 N. Plum St., Lancaster, Pa.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

TAPPING MACHINES
Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
Baush Machine Tool Co., 15 Wason Ave., Springfield 7, Mass.
Bodine Corp., 317 Mt. Grove St., Bridgeport 5, Conn.
Buhr Machine Tool Co., 839 Greene St., Ann Arbor, Mich.
Burg Tool and Mfg. Co., Inc., 15001 S. Figueroa, Gardena, Calif.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York 17, N. Y.
Cincinnati Bickford Div. of Giddings & Lewis Mch. Tool Co., Oakley, Cincinnati 9, Ohio.
Cross Co., P. O. Box 3835, Park Grove Postal Sta., Detroit 5, Mich.
Edlund Machinery Co., Cortland, N. Y.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Kaufman Manufacturing Co., Manitowac, Wis.
Kingsbury Mch. Tool Corp., Keene, N. H.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Landis Mch. Co., Waynesboro, Pa.
Le Maire Machine Tool Co., 2657 S. Telegraph Rd., Dearborn, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

TAPS, Hand, Machine Screw, Pipe, etc.
DoAll Co., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
Jarvis Corp., Stack Ave., Middletown, Conn.
Sheffield Corp., Box 893, Dayton 1, Ohio.
Threadwell Tap & Die Co., Greenfield, Mass.
Winter Bros. Co, Rochester, Mich.

TAPS, Collapsing
Geometric-Horton Div., United Greenfield Corp., New Haven, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Landis Mch. Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Sheffield Corp., Box 893, Dayton 1, Ohio.

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Design of high-speed precision machinery often calls for bearings which offer the utmost in load capacity, "hot hardness", dimensional stability. Each machine presents its own exacting requirements.

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TESTING EQUIPMENT, Air, Oil & Water Pressure
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.

THREAD CUTTING MACHINES
Davis & Thompson Co., 4460 W. 124th St., Milwaukee 10, Wis.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Landis Mch. Co., Waynesboro, Pa.
Sheffield Corp., Box 893, Dayton 1, Ohio.

THREAD CUTTING TOOLS
Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago 46, Ill.
Geometric-Horton Div., United Greenfield Corp., New Haven, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Landis Mch. Co., Waynesboro, Pa.
Sheffield Corp., Box 893, Dayton 1, Ohio.

THREAD ROLLING DIES—See Dies, Thread Rolling

THREAD ROLLING EQUIPMENT
Landis Mch. Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland 3, Ohio.
National Machinery Co., Tiffin, Ohio.
Reed Rolled Thread Die Co., P. O. Box 350, Worcester 1, Mass.
Sheffield Corp., Box 893, Dayton 1, Ohio.
Waterbury Farrel Foundry & Mch. Co., Waterbury, Conn.

TOOL CONTROL BOARDS
Cross Co., P. O. Box 3835, Park Grove Postal Sta., Detroit 5, Mich.

TOOL HOLDERS
Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago 46, Ill.
Bridgeport Mches, Inc., 500 Lindley St., Bridgeport 6, Conn.
Burgmaster Corp., 15001 S. Figueroa, Gardena, Calif.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
DeVlieg Microbore Div., 2720 W. Fourteen Mile Road, Royal Oak, Mich.
DoALL Co., Des Plaines, Ill.
Kennametal, Inc., Latrobe, Penna.
Metal Carbides Corp., 6001 Southern Blvd., Youngstown 12, Ohio.
Vascoloy-Ramet Corp., Waukegan, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

TOOL MATERIAL, Cast Non-Ferrous Alloy
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago 46, Ill.
Vascoloy-Ramet Corp., Waukegan, Ill.

TOOL MATERIAL, Cemented Carbide
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago 46, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio
DoALL Co., Des Plaines, Ill.
Kennametal, Inc., Latrobe, Penna.
Metal Carbides Corp., Youngstown 12, Ohio.
Vascoloy-Ramet Corp., Waukegan, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.

TOOL MATERIAL, Ceramic
Metal Carbides Corp., Youngstown 12, Ohio.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Vascoloy-Ramet Corp., Waukegan, Ill.

TOOL MATERIAL, High-Speed Steel
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago 46, Ill.
Carpenter Steel Co., 105 W. Bern St., Reading, Penna.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
Vanadium-Alloys Steel Co., Latrobe, Penna.

TRACING ATTACHMENTS
American Tool Works Co., Pearl & Eggleston Aves., Cincinnati 2, Ohio.
Gisholt Mch. Co., 1245 E. Washington Ave., Madison 10, Wis.
Gorton Mch. Co., 1321 Racine St., Racine, Wis.
Jones & Lamson Mch. Co., 512 Clinton St., Springfield, Vt.
Wales-Strippit, Inc., Akron, N. Y.
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio.

TRANSFER MACHINES
See Multiple-Station Machines

TRANSMISSION, Variable Speed
Barnes, John S. Corp., Rockford, Ill.
Boston Gear Wks., Quincy, Mass.
Denison Engineering, Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus, Ohio.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Vickers, Inc., Detroit 32, Mich.

TRUCKS, Material Handling
Hamilton Tool Co., 834 So. 9th St., Hamilton, Ohio.

TUBE-FLANGING MACHINES
Niagara Mch. & Tool Wks., 637-697 Northland Ave., Buffalo 11, N. Y.

TUBE FORMING AND WELDING MACHINES
Yoder Co., 5504 Walworth Ave., Cleveland, Ohio.

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Yoder Co., 5504 Walworth Ave., Cleveland, Ohio.

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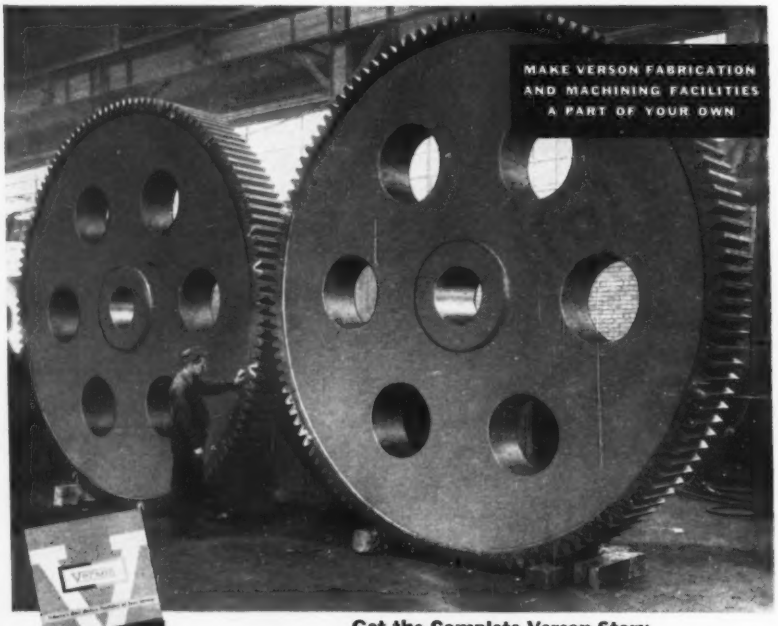

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WHERE DO YOU LOOK FOR LOWER COSTS?

to longer life from a tool costing 4¢ an hour or to greater output from a machine that costs $8 an hour

THIS COMPARISON TELLS THE STORY
(This is only one of many examples . . . details of others on request)

	240 minute tool life setup TOOL COST: 4¢/hr.	25 minute tool life setup TOOL COST: 40¢/hr.
Machine cost per hour	$ 8.00	$ 8.00
Tool cost per hour	$ .04	$ .40
Cost per 8-hour shift	$64.32	$67.20
Pieces run per shift	51	181
COST PER PIECE	$ 1.26	$ .37

Here's how some shops have doubled...tripled...quadrupled the output of expensive machines

From many machine shops the story is the same—*they sacrificed low-cost carbide inserts through increased feeds and speeds . . . and achieved startling savings in total-cost-per-piece.* Production increases even greater than 100% have been recorded. The increased tool costs were insignificant by comparison.

Where machines have been operating at less than maximum efficiency, *unit cost can be reduced overnight* . . . merely by using modern cutting tools to get full potential machine output . . . instead of operating at fractional machine capacity to gain long tool life.

This idea has been PROVEN-IN-USE by many progressive plants. We will gladly send you records of such operations. These results can be duplicated in plants where machines and talented operators have been held back by old ideas about tooling and tooling costs. Ask your Kennametal Carbide Engineer how Kendex* (patented) tooling can help get more efficient output from *your* machines . . . or write KENNAMETAL INC., Latrobe, Pennsylvania, for additional information.

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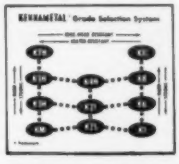
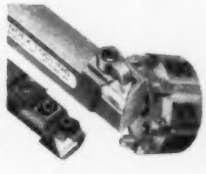
. . . Partners in Progress

TO MULTIPLY YOUR MACHINE OUTPUT ...YOU NEED 3 THINGS:

The 'Three-Man Tooling Team' that utilizes the specialized knowledge of your Tool Engineer, your Machine Operator, and the Kennametal Carbide Engineer . . . *to get the right tooling on every job.*

The Kennametal complete range of grades that provides the precise properties and uniformity that permits *accurate prediction of tool life.*





Kendex Instant insert change without need to reposition the tool. This is the key to this new practice . . . *frequent tool change without excessive down-time.*

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TUBING, Non-ferrous
American Brass Co., 25 Broadway, New York, N. Y.
Metal Forming Corp., Elkhart, Ind.
Mueller Brass Co., Port Huron 34, Mich.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 18, Ill.

TUBING, Steel
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Carpenter Steel Co., 105 W. Bern St., Reading, Penna.
Metal Forming Corp., Elkhart, Ind.
National Tube Div., U. S. Steel Corp., 525 Wm. Penn Place, Pittsburgh, Pa.
Revere Copper & Brass Inc., 230 Park Ave., New York 17, N. Y.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 18, Ill.
Timken Roller Bearing Co., Canton, Ohio.

TUBE & PIPE CUTTING-OFF MACHINES
Grieder Industries, Inc., Bowling Green, Ohio.
Sheffield Corp., Box 893, Dayton 1, Ohio.

ULTRASONIC MCH. TOOLS
Sheffield Corp., Box 893, Dayton 1, Ohio.

VALVE CONTROLS
Barnes, John S. Corp., Rockford, Ill.
Logansport Mch. Co., Inc., Logansport, Ind.
Vickers, Inc., Detroit 32, Mich.

VALVES, Air
Hydraulic Press Mfg. Div., Mt. Gilead, Ohio.
Logansport Mch. Co., Inc., Logansport, Ind
Mechanical Air Controls, Inc, Oak Park, Mich.
Numatics, Inc., Milford, Mich.
Ross Operating Valve Co., 110 E. Golden Gate Ave., Detroit 3, Mich.
Schrader's Son, A., 470 Vanderbilt Ave., Brooklyn 38, N. Y.
Skinner Electric Valve Div., New Britain, Conn.
Tomkins-Johnson Co., 617 N. Mechanic St., Jackson, Mich.

VALVES, Hydraulic
Barnes, John S. Corp., Rockford, Ill.
Denison Engineering Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio.
Elmes Eng. Div., American Steel Foundries, 1150 Tennesee Ave., Cincinnati 29, Ohio
Hydraulic Press Mfg. Div., Mount Gilead, Ohio.
Logansport Machine, Inc., 810 Center Ave., Logansport, Ind.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Vickers Incorporated, Division of Sperry Rand Corp., 1402 Oakman Blvd., Detroit, Mich.

VERNIERS—See Calipers, Vernier; Gages, Vernier

VISES, Machine
Bridgeport Mches, Inc., 500 Lindley St., Bridgeport 6, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio.
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Modern Mch. Tool Co., 2005 Losey Ave., Jackson, Mich.
Producto Mch. Co., 990 Housatonic Ave., Bridgeport, Conn.
Universal Engineering Co., Frankenmuth 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.

WELDING EQUIPMENT, Arc
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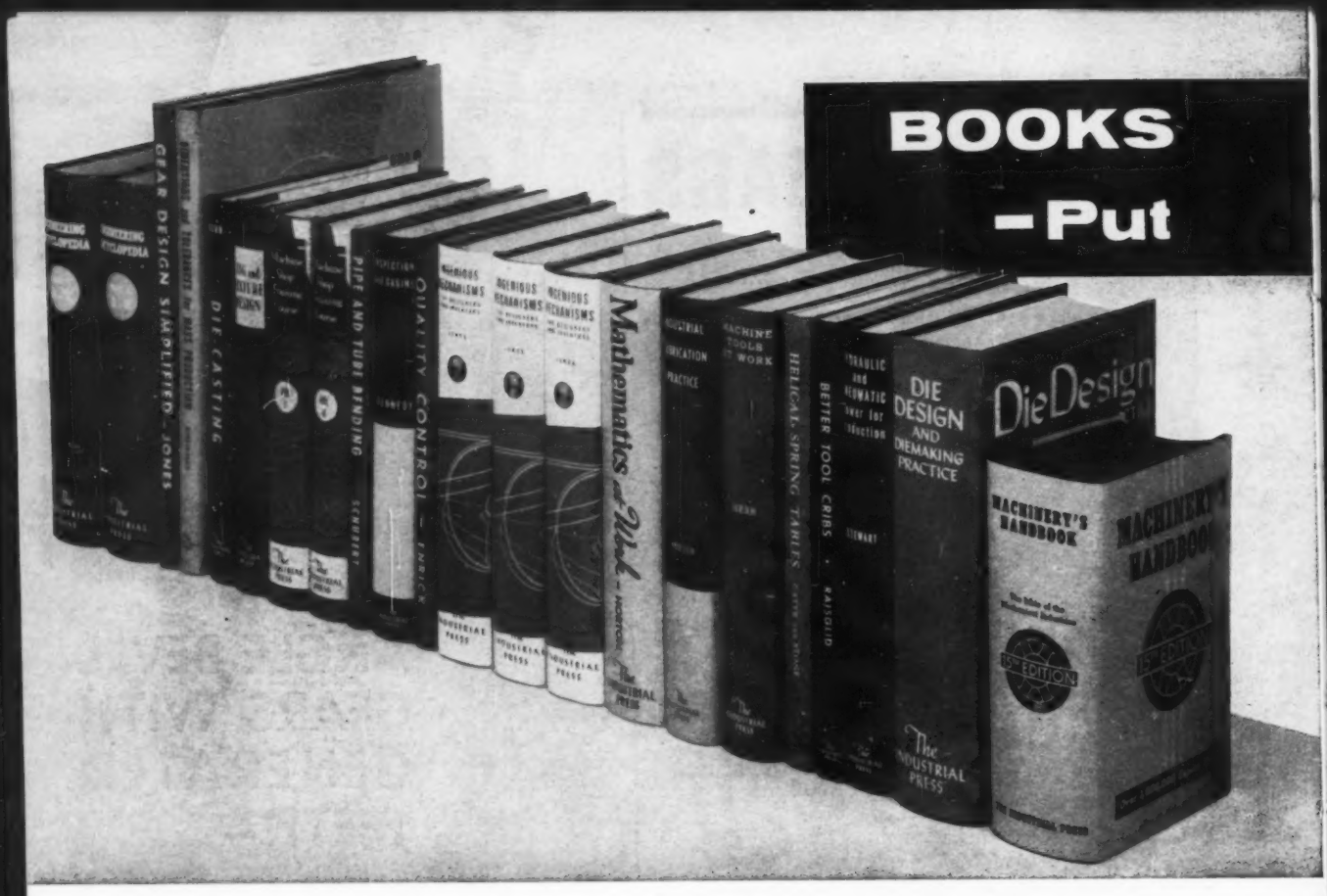

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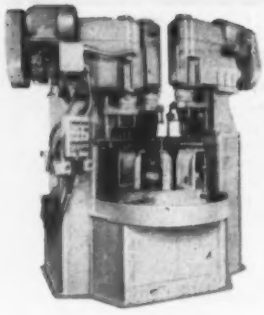

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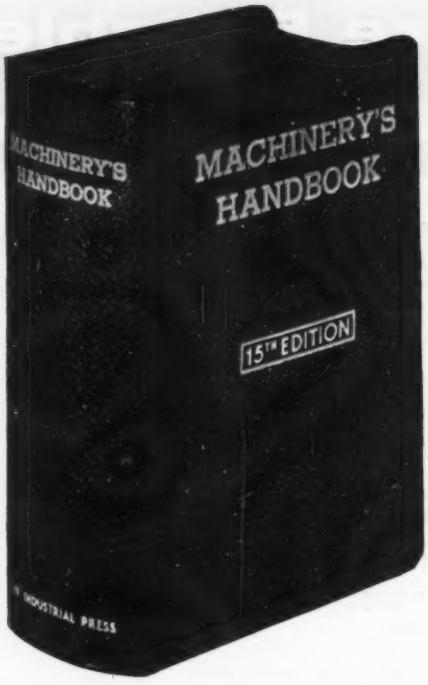

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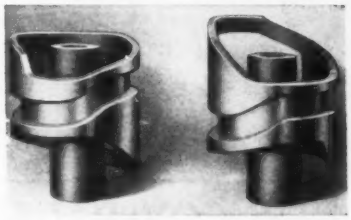

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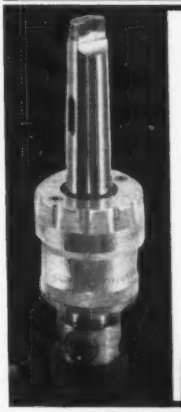

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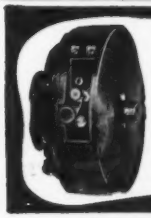

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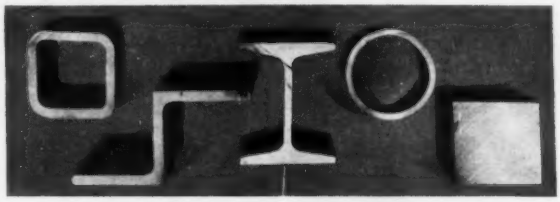

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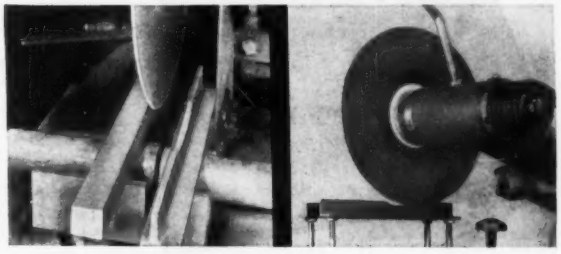

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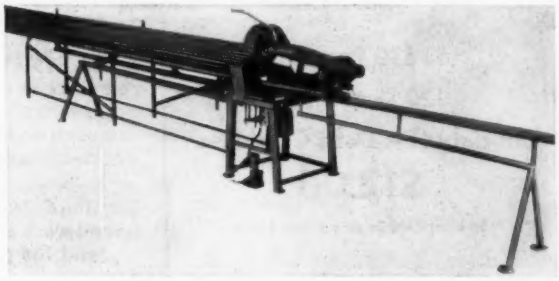

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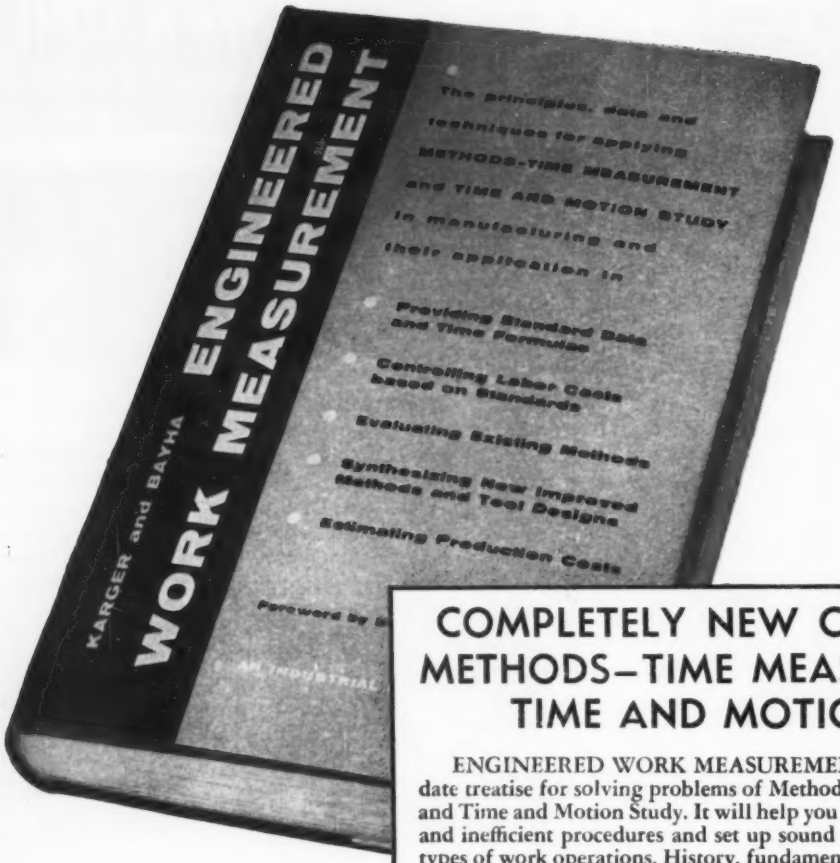
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Subsidiary of North American Aviation, Inc.

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DIATRONIC* DIAMOND WHEELS
"with built-in tolerance" *TRADEMARK

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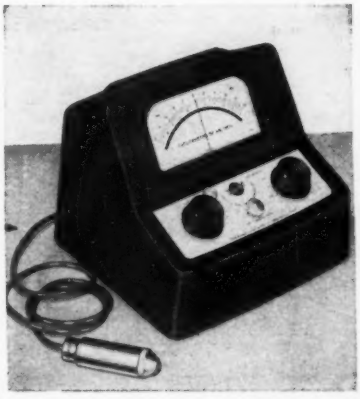

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ELECTRONIC COMPARATOR

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- Operating pressure of less than 3 ounces
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- Flexible zero adjustment on the most sensitive range. Gaging head can be set up in a simple split clamp without need for fine mechanical adjustment

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CLASSIFIED ADVERTISING RATES: $12 per single column inch

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THE SIGN OF QUALITY

THE MARK OF DEPENDABILITY

The listing below is only a VERY SMALL AMOUNT of the total number of machine tools that we have in stock for immediate shipment. Our prices are realistic with today's market and our quality of rebuilding is the same high standard— THE LEADER IN THE FIELD OF REBUILT MACHINE TOOLS.

INTERNAL GRINDERS

Type IG 103 Grenby, m.d.
No. 5 Bryant, m.d., latest
Model 5Y Bryant, m.d.
No. 16-16" Bryant, m.d., hydraulic hole grinder
No. 16CH16 Bryant, m.d., Latest
No. 16-22" Bryant, m.d., latest
No. 16-36" Bryant, m.d., latest
No. 16-A-28" Bryant, m.d.
No. 24-36" Bryant Hole & Face Type, m.d., late
No. 24-P-26" Bryant, m.d.
No. 24-21" Bryant, m.d.
No. 24-L-36" Bryant, m.d., late
No. 24-LW-36 Bryant, m.d., late
No. 649-16" Van Norman Automatic Oscillating Radius, m.d., latest
No. 70A Heald, m.d., latest, 1945
No. 72A3 Heald Full Universal, m.d.
No. 72A3 Heald Gagematic, m.d.
No. 72A3 Heald Sizematic, m.d.
No. 72A3 Heald Plain, m.d.
No. 72A5 Heald Plain, m.d.
No. 73 Heald Airplane, m.d., latest, new
No. 74 Heald Long Base, 1945
No. 74 Heald Extended Bridge Type, m.d.
No. 74 Heald, Plain Long Base, m.d., 1943
No. 74 Heald, m.d.
No. 75A Heald, m.d., latest
No. 81 Heald Gagematic, Sizematic, m.d.
No. 81 Heald Plain & Sizematic, m.d.
No. 104 Rivett, m.d.
No. 172 Heald Plain Adjusable Gap Hydraulic, m.d.

PLAIN CYLINDRICAL GRINDERS

No. 5 Brown & Sharpe Plain, m.d., 1942
No. 20-10x18" cap. Brown & Sharpe Plain, m.d.
4x12" Landis Type H Knee Hole Type, m.d.
6x18" Cincinnati Model EA, m.d.
6x18" Landis Type C Hydraulic, m.d., late
6x18" Norton Plain Grinder, m.d.
10x18" Cincinnati Plain Hydraulic, Model ER, m.d., Filmatic Spindle, 1943
10x18" Cincinnati Model EA, m.d.
10x18" Norton Type C, m.d., latest
10x36" Cincinnati Hydraulic, m.d.
10x36" Norton Type C, m.d.
10x36" Landis Type CH Plain, m.d.
10x48" Cincinnati Model ER Plain Hydraulic, m.d.
12x36" Landis Plain Self-Contained, m.d.
14x36" Landis Type C, 1945
16x96" Cincinnati Plain, m.d.
16x40"x120" Cincinnati Plain Heavy Duty, 1953
16"x120" Landis Type B Plain H.D. Hydraulic, m.d., late
18"x36" Landis Type C, m.d.
18"x72" Norton Type C, mechanical, m.d.
23"x156" ce Norton Type C, m.d.
23"x72" ce Type C Norton Semi-Auto. Hydraulic
25"x72" Landis Type C, m.d.
42"x72" ce Norton, m.d.

HONE MACHINES

No. 3 Barnes Single Spindle Internal Hone, new
No. 182 Barnesdrill, m.d.
No. 854 Micromatic Vertical Honing Machine, m.d.
H1 Micromatic Horizontal Hydrohoner, m.d.
H 4 Micromatic Horizontal Hydrohoner, m.d.
No. 6 Barnes Twin Spindle
No. 306H Barnes Twin Spindle
No. 224B Barnes Honing Machine, m.d.
Model 4014C Barnes Self-Oiling Hydraulic Vertical
Model MA Sunnen Bench Type, m.d.

KEYSEATERS

Morton, m.d., thru reversing gear box
Taylor & Fenn Horizontal Shaving, Shaping Keyseating, m.d., 1942
W-L-W Machine Keyseater, new

TOOL & CUTTER GRINDERS

No. 91A Covel Universal, m.d.
Pratt & Whitney Deep Hole Drill Sharpener, m.d.
No. 1 Heald Tool Sharpener, m.d.
No. 2A Wm. Sellers Universal Tool Grinder, m.d.
No. 2B Sellers Wet Drill Grinder, m.d.
No. 4T Sellers Tool, m.d., latest
No. 5T Sellers, m.d.
No. 6G Sellers, m.d.
12" Gleason Spiral Bevel, Gear Cutter Sharpener, m.d.
No. 13 Gleason Cutter Sharpener, m.d., late
No. 13 Brown & Sharpe Universal, m.d.
No. 4-4 Barber-Colman Hop Sharpener, m.d.
Sundstrand Tool Grinder, m.d.
12x88" Landis Universal & Tool Grinder, m.d.
No. 51 Oliver Drill Pointer, m.d.

MANUFACTURING LATHES

12x33", 20"x25" Jones & Lamson Fay Automatic Lathes, 1944
No. 3 Lodge & Shipley Duomatic, m.d., late type
No. 3A Lodge & Shipley Duomatic, m.d.
No. 4 R.K. LeBlond Boring Lathe, 37" bed, 4" hole, m.d., latest
No. 9, 12 LeBlond Multi-Cut, m.d.
No. 12 Gisholt Auto Prod., m.d.
No. 16 LeBlond Automatic, m.d.
4x60" LoSwing, m.d.
11x18" LeBlond Rapid Production, m.d.
12x18" Reid Small Piece Production, Model 6WSL, m.d.
Model U, 14"x24" centers LoSwing, m.d.
No. 9WSL, Reid Production, m.d.
17"x75-¾" LeBlond, m.d.
No. 10 Sundstrand Automatic Production, m.d.
No. 12 Sundstrand Automatic Production, m.d.
14"x21" centers Model LS Semi-Automatic LoSwing, m.d.
Lipe Semi-Automatic Carbo Lathe, m.d.
13"x12¼" centers LeBlond H.D. Rapid Production, m.d.
Model B1 Blount Speed Lathe, m.d.
Colburn Mfg. Bench Type Speed Lathe, m.d.
Model NA2B Schauer Speed Lathe
Cir-Dan, Type B, Semi-Automatic H.S., single point Threading Machine, new
10x20" centers Hi-Turn, new

The above is only a partial listing

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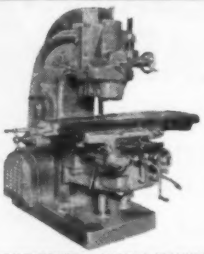

MODERNIZE YOUR PLANT WITH MILES REBUILT TOOLS

This No. 3 KM Kearney & Trecker dial-type vertical milling machine is typical of the fine machine tools available at Miles. Completely rebuilt to new tool tolerances and ready to go. Price $9500.

BALANCER. Model 2E0 Tinius Olsen, 1948
BORER, No. 1212 Excell dbl. end
BORING MILL. 3¾" bar No. 5 DeHance, 1942
BORING MILL. 4" Universal Tri-Way 1000 RPM
BORING MILL. 60" Gisholt vert. PRT
CENTERING MACHINES. Nos. 53 & 56 Sundstrand up to 72" between centers
CHUCKER. 675 New Britain late
GEAR HOBBERS, No. 3 and type A Barber-Colman, late
GRINDERS, C'LESS. No. 12 Landis, 1947
GRINDER, CYL. 4" x 12" No. H. Landis, 1943
GRINDERS, CYL. 20" x 72" Landis, 1943
GRINDER, INT. No. 271 Heald size matic 1951
GRINDER, INT. 72A5 Heald, Univ., Hydr.
GRINDER, INT. No. 74 Heald Hydr., 1941
GRINDER, SURF. 8" x 24" x 36" DoAll hydr. 1948
GRINDER, SURF. 20" x 24" No. 25A Heald
GRINDER, SURFACE. 12" x 16" x 36" Mattison. Mag. chuck and rect., 1942
GRINDER, CUTTER. 30" Ingersoll, 1942
GRINDER, CARBIDE, Nos. 48 and 49 Excello
GRINDER, RADIUS, No. 49 VanNorman, late
GRINDER, TOOL & CUTTER. No. 2 Cincinnati
HOB SHARPENER. Type HRS Barber Colman
KELLER. BL2416 Pratt & Whitney 3 Spdl. 1941
LATHE, 16" x 54" AMERICAN "PACEMAKER" 1941
LATHES, ENGINE. 13", 15" & 17" LeBlond
MILLER, AUTO 56" No. 33 Sundstrand
MILLER, DUPLEX, 4-48 CINCINNATI 1945
MILLER HAND. No. 2RV Kent-Owens, 1942
MILLERS. No. 10 & 3 VanNorman Duplex
MILLER, PLAIN. No. 2 Cincinnati HSDT. 1940
MILLER PLAIN. No. 3H K & T MSDT 1943
MILLER VERT. No. 2 Brown & Sharpe HSDT. 1943
MILLER. No. 36 VanNorman, ram type. 1942
MILLING MACHINE, HORIZONTAL, No. 5H Kearney & Trecker plain with Vert Hd 1941
PLANER, 66" Rockford hydr. openside 1941
SAW 10" x 10" Racine Hydr., Hack, 1941
SHAPER. 6" P&W vert., also 12"
SHAPER, 16" Rockford hydr. univ. 1943
SLOTTER, 36" Rockford Hydraulic, 1942, excellent
TAPPER No. 10 Warner & Swasey, 1948
THREADER. 1¼" HILL ACME LEAD SCREW 1942

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4" x 18" CINCINNATI Cyl. Grinder, Late Type.
No. 3 CINCINNATI H.S. D.T. Horiz. Mill, NEW 1945. Extra table travel, vert. heads.
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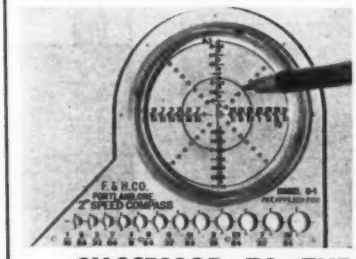

Now, draw circles with a spin of the draftman's pencil in this new SPEED circle template. Smooth ball-bearing action assures effortless drawing. Compact, always ready for use. Insures greater accuracy.

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provides jig grinder performance at drill press prices

- *Fine radial adjustment from "0" to .070" while the spindle is rotating.*
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- *Adapted to include holes up to 5½"*
- *Sealed air turbine and spindle bearings*

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Greenfield, Mass.

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Stops Losses making Dies and Templates

Popular package is 8-oz. can fitted with Bakelite cap holding soft-hair brush for applying right at bench; metal surface ready for layout in a few minutes. The dark blue background makes the scribed lines show up in sharp relief, prevents metal glare. Increases efficiency and accuracy.

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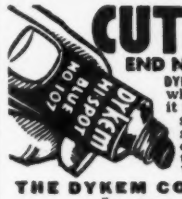
CUT SCRAPER TIME

END NIGHT CLEANUP & MORNING REBLUING



DYKEM HI-SPOT BLUE No. 107 is used to locate high spots when scraping bearing surfaces. As it does not dry, it remains in condition on work indefinitely, saving scraper's time. Intensely blue, smooth paste spreads thin, transfers clearly. No grit; noninjurious to metal. Uniform. Available in collapsible tubes of three sizes. Order from your supplier. Write for free sample tube on company letterhead.

THE DYKEM CO., 2303R NORTH 11TH ST., ST. LOUIS 6, MO.

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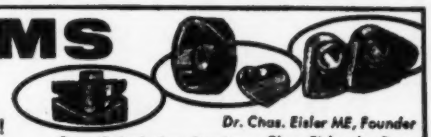
ALL TYPES MADE TO YOUR SPECS!



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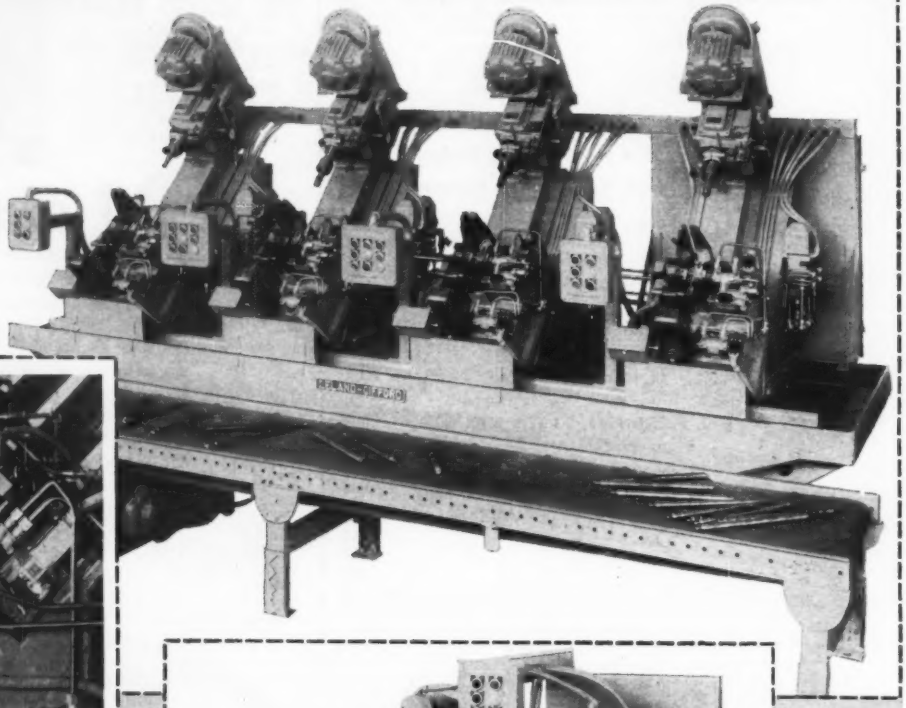

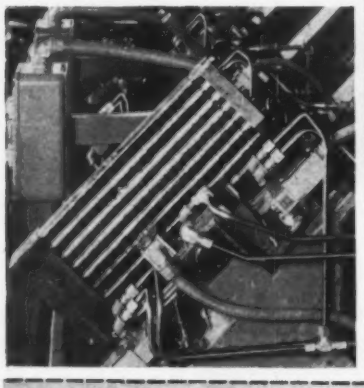

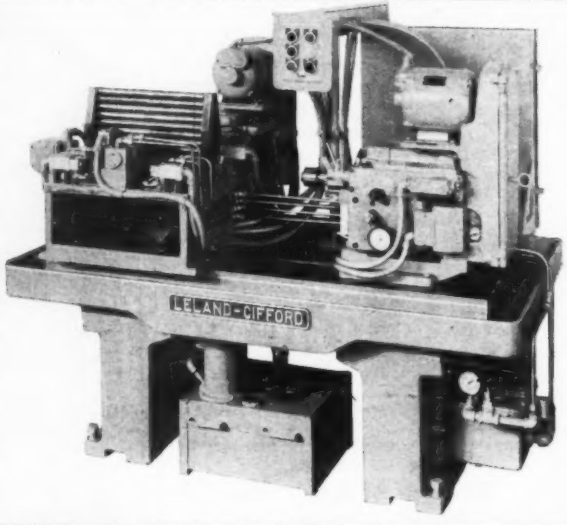

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Hopper feed 4-station deep hole drilling unit. Each station automatically loads, positions and drills 3/16″ x 5.860″ hole in automatic transmission part. Discharge to conveyor at 100 pcs. per hour.

STEP 2

Convey to second unit, drill small cross hole to meet deep hole and ream deep hole. Eject to conveyor at 200 pcs. per hour.

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For more data, circle this page number on inquiry card

Alphabetical Index of Advertisers

A

Air Reduction Sales Co. 222
Allegheny Ludlum Steel Corp. . 243
Allen-Bradley Co. ... Insert 73-74
American Brass Co. 227
American Schiess Corp. 63
American Sip Corp. 179
American Steel Foundries 197
American Tool Works Co. 205
American Waldrich Mfg. Corp. 62
Armstrong-Blum Mfg. Co. 20
Armstrong Bros. Tool Co. 88

B

Ball & Roller Bearing Co. 297
Barber-Colman Co. Insert 75-76, 82
Bardons & Oliver Inc. 253
Barnes Drill Co. ..... Insert 83
Barnes, W. F. & John Corp. Insert 78
Beatty Machine & Mfg. Co. ... 246
Berthiez, Charles 44-45
Best Values 297
Bethlehem Steel Co. 65, 255
Bilgram Gear & Machine Wks. 291
Blanchard Machine Co. 28
Bliss, E. W., Co. 89
Boston Gear Works 247
Brown and Sharpe Mfg. Co. Front Cover
Buck Tool Co. 263
Buckeye Tools Corp. 240
Buffalo Forge Co. 58
Buhr Machine Tool Co. Insert 51-54
Bullard Co. 271
Bunting Brass and Bronze Co. 259
Burg Tool Mfg. Co., Inc. 38-39

C

Cadillac Gage Co. 49
Capewell Mfg. Co. 250
Carpenter Steel Co. 91
Chambersburg Engrg. Co. ... 40
Chicago Pneumatic Tool Co. .. 193
Cincinnati Gear Co. 254
Cincinnati Lathe & Tool Co. .. 187
Cincinnati Milling Machine Co. 6-7
Cincinnati Milling Products Div., Cincinnati Milling Machine Co. 37
Cincinnati Shaper Co. 237
Circular Tool Co., Inc. 226
Classified Advts. 298
Clearing Div., U. S. Indus. Inc. Back Cover
Cleveland Crane & Engrg. Co. 90
Cleveland Punch & Shear Works Co. 277
Cleveland Twist Drill Co. 249
Cogsdill Twist Drill Co. Inside Back Cover
Columbus Die-Tool & Mch. Co. 282
Cross Company 16-17

D

Davall Gear Co., Ltd. 297
Denison Engineering Div., American Brake Shoe Co. .. 70
Detroit Power Screwdriver Co. 286
Diefendorf Gear Corp. 291
DoAll Co. 94
Drillmation Co., Inc. 241
Dykem Co. 299

E

Edlund Machinery Co. 269
Eisler Engineering Co., Inc. .. 299
Ex-Cell-O Corp. 41, 211, 225

F

F&H Manufacturing Co. 299
Fafnir Bearing Co. 185
Federal Press Co. 262
Federal Products Corp. 57
Fellows Gear Shaper Co. 4-5
Fosdick Machine Tool Co. ... 18-19

G

Gallmeyer & Livingston Co. .. 199
Gardner Machine Co. 21
Gear Grinder Div., Gear Grinding Machine Co. 223
Gear Grinding Machine Co., Gear Grinder Div. 223
Gisholt Machine Co. 56
Gleason Works 59
Goss & DeLeeuw Mch. Co. 238
Gray, G. A. Co. 22-23
Greaves Machine Tool Div., J. A. Fay & Egan Co. 248
Greenlee Bros. & Co. .. Insert 81
Grieder Industries, Inc. 290

H

Hamilton Tool Co. 224
Hanchett Magna-Lock Corp. .. 256
Hardinge Brothers, Inc. 98
Heald Machine Co., The Inside Front Cover
Hill Acme Co. 257
Hoover Ball & Bearing Co. Insert 221
Hydraulic Press Mfg. Co. 61

I

Industrial Distributors (Sales), Ltd. 229
Industrial Press 244-245, 292-293, 296
Ingersoll Milling Machine Co. 275
Innocenti Corp. 86-87

J

Jacobs Manufacturing Co. .. 24-25
James, D. O., Gear Mfg. Co. .. 260
Johnson, S. C. & Son, Inc. ... 30-31
Jones & Lamson Machine Co. 48, 68

K

Kato Mfg. Co. 295
Kaufman Manufacturing Co. 294
Kearney & Trecker Corp. 233
Kennametal, Inc. 289
King Machine Tool Div., American Steel Foundries .. 197
Kingsbury Mch. Tl. Corp. 207

L

Landis Machine Co. 2-3
Landis Tool Co. 8-9
Leland-Gifford Co. 300
Lempco Industrial, Inc. 251
Lepel High Frequency Laboratories, Inc. 266
Lincoln Electric Co. 180
Logan Engineering Co. 228
Logansport Machine Co., Inc. 55
Lucas Machine Div., New Britain Machine Co., The ..... Insert 71-72

M

Machine Products Corp. 252
Macklin Co. 93
Mattison Machine Works Insert 77
Mechanical Air Controls, Inc. 267
Metal Carbides Corp. 46
Metallizing Engineering Co., Inc. 195
Metallurgical Products Dept., of General Electric Co. .. 234-235
Micromatic Hone Corp. .. 264-265
Minnesota Mining & Mfg. Co. 273
Modern Devices 268
Modern Machine Tool Co. 272
Moline Tool Co. 242
Monarch Machine Tool Co. ... 29
Motch & Merryweather Machinery Co. 279
Mueller Brass Co. 230-231
Mummert-Dixon Co. 295

N

National Acme Co. 66-67
National Automatic Tool Co., Inc. ..... Insert 219-220
National Broach & Machine Co. 69
National Machinery Co. 283
National Tube Div., United States Steel Corp. 285
Navan Products, Inc. 297
Nebel Machine Tool Co., Nebel Machine Tool Div. 281

Alphabetical Index of Advertisers

New Britain Machine Co., The, Lucas Machine Div. . Insert 71-72
New Britain Machine Co., The, New Britain-Gridley Machine Div. 32-35
New Jersey Gear & Mfg. Co. .. 295
Norton Company .. 14-15, 216-217

O

Oakite Products, Inc. 50
Olivetti Corp. of America 261
Olofsson Corp. 191
Orban, Kurt, Co., Inc. 177
Osborn Manufacturing Co. ... 284

P

Pangborn Corporation 302
Producto Machine Co. 213

R

Reed Rolled Thread Die Co. .. 236
Rockford Machine Tool Co. Insert 84
Rollway Bearing Co., Inc. ... 287
Ross Operating Valve Co. 189
Rowbottom Machine Co. 295
Ryerson, Joseph T. & Son, Inc. 100

S

Scherr, George, Co., Inc. 294
Sheldon Machine Co., Inc. 232
Shore Instrument & Mfg. Co., Inc. 276
Sidney Machine Tool Co. 42-43
Sinclair Refining Co. 64
Skinner Chuck Co. 96
Snyder Corp. 203
Stahl Gear & Machine Co. 291
Standard Oil Co. (Indiana) 26-27
Starrett, L. S., Co. 208
Sundstrand Machine Tool Co. Insert 79-80

T

Texas Company 47
Textile Machine Works 36
Thompson Grinder Co. 85
Threadwell Tap & Die Co. 297, 299
Timken Roller Bearing Co. Steel & Tube Div. 239
T. N. F. Corp. 294

U

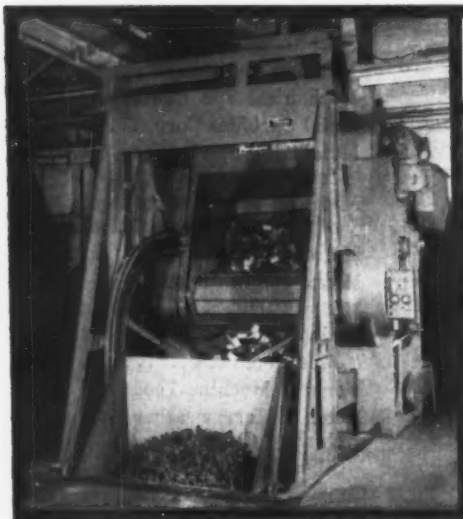
United States Steel Corp. 285
U.S. Tool Company, Inc. 10-11
Universal Engineering Co. ... 60
Vanadium-Alloys Steel Co. ... 95
Verson Allsteel Press Co. 288

W

Waldes Kohinoor, Inc. 201
Wales Strippit Inc. 258
Wallace Supplies Mfg. Co. 295, 297
Warner & Swasey Co. 12-13
Wheelock, Lovejoy & Co., Inc. 274
Wollensak Optical Co. 280

Y

Yoder Co. 92



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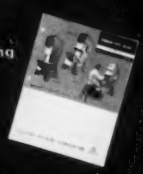

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